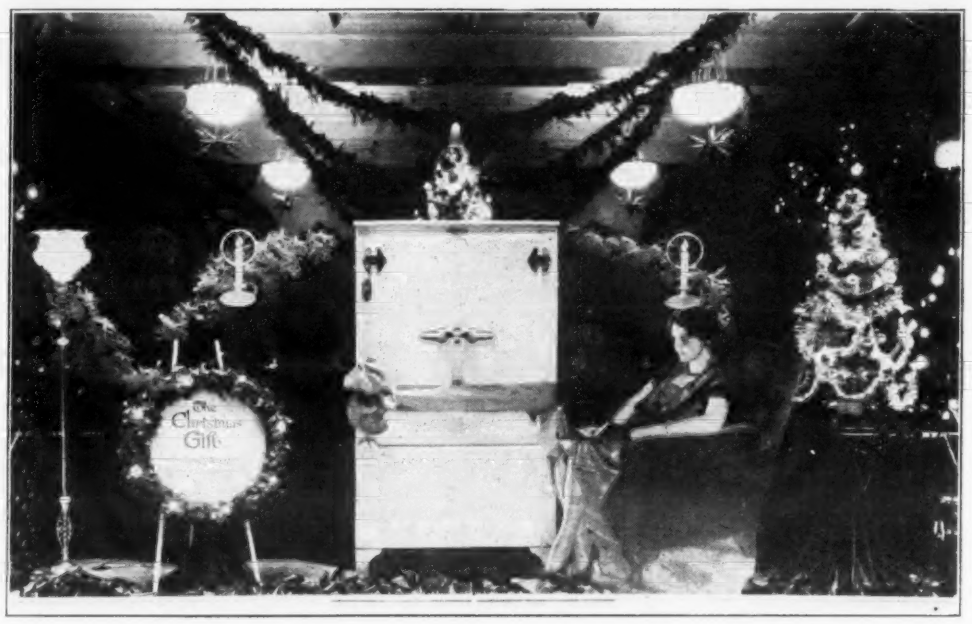
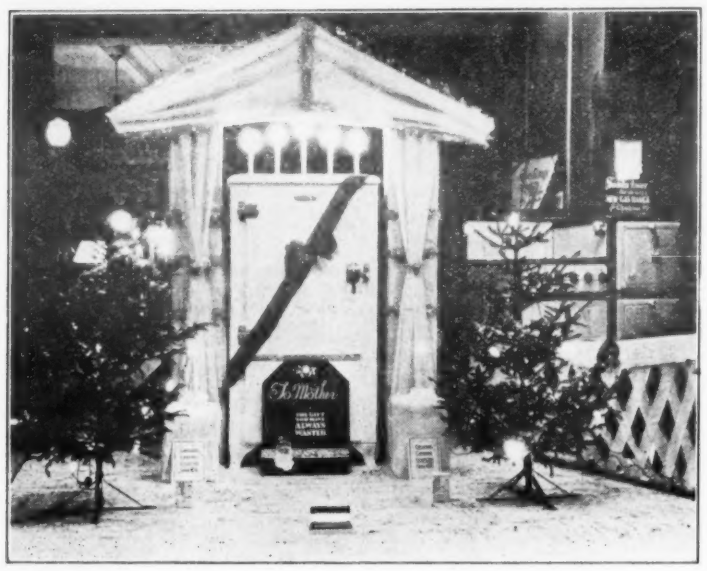
CHRISTMAS SPIRIT REIGNS OVER INDUSTRY

One of the windows competing for prizes in the national Electric Refrigeration Bureau is this one of the Public Service Co. of Northern Illinois, Joliet.

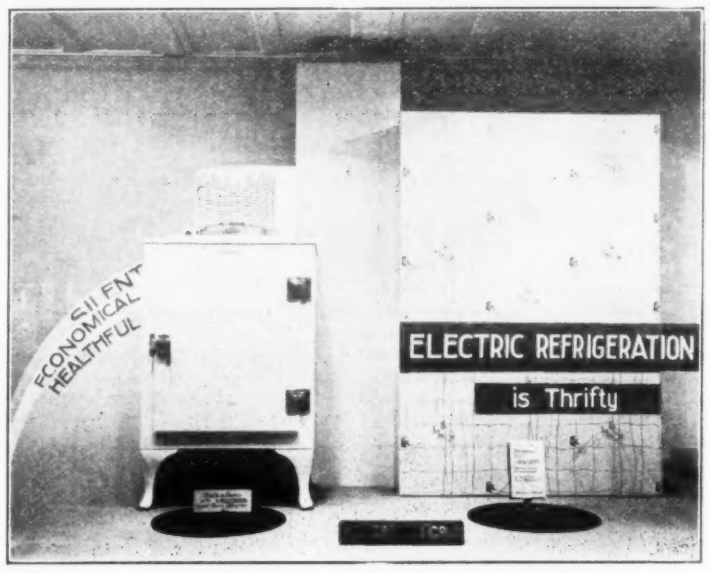


A Christmas scene was the basis of the Frigidaire window display of Gas & Electric Appliance Co., Cincinnati, O. The display is also entered in the national contest.



This Kelvinator model formed the center of the window display of the Twin State Gas & Electric Co., Brattleboro, Vt.

Miss Diana Brent demonstrates the temperature selector on Westinghouse refrigerators at the opening of Ray Thomas, Inc., salesroom, Los Angeles.



Simplicity and dignity marked the General Electric window display of T. Eaton Co., Ltd., Hamilton, Ontario.

Engene Leier will become commercial manager of Board River Power Co., Columbia, S. C.

Santa Claus has been traveling the streets of Detroit nightly on the Frigidaire truck. A snow-covered truck and Christmas colors have been used along with two Frigidaire units.

J. S. Dohany, Kelvinator sales promotion department, has been named assistant regional manager.

Here are the latest additions to Kelvinator's home economics department, both in the home office and in distributors' headquarters. These girls are (left to right): Emily Bogarry, Neches Electric Co., Beaumont, Tex.; Angela Allen, Philadelphia; Bertha Banspach, Neches Electric Co., Texas; Nell Penny, Dallas, Tex.; Eva M. McPherson and Thelma Williams, factory staff.

Written to be Read On Arrival

Merchandising Section

In Two Parts Part One

ELECTRIC REFRIGERATION NEWS

Registered U. S. Patent Office.

The business newspaper of the refrigeration industry

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TEN CENTS PER COPY
TWO DOLLARS PER YEAR

COPELAND SHOWS $314,411 PROFIT FOR FISCAL YEAR

Each Share Earns $6.04; Sales Increase 19.09% During Year

MT. CLEMENS, Mich.—Consolidated net profits of Copeland Products, Inc., for the fiscal year ended Oct. 31, 1931, are $314,411.48, after provision for depreciation, reserves and Federal taxes, Louis Ruthenburg, president, announces.

This is $6.04 on the 51,991.7 shares outstanding, and compares with net profits for the previous fiscal year of $107,038.61, or $2.05 per share as related to the present capital structure.

"The ratio of current assets to current liabilities is 3.02 to 1, as compared with 2.01 to 1 for the previous fiscal year," Mr. Ruthenburg's report states.

"There are no senior securities, funded indebtedness or bank loans, whereas on Oct. 31, 1930, there were outstanding bank loans of $250,000. Cash on hand as of Oct. 31, 1931, was $167,733.14, as compared with $119,526.26 as of the same date a year ago.

"Net sales for 1931 increased 19.09 per cent over those of 1930. Unit shipments for the comparable period increased 23.09 per cent. Both net sales and unit shipments surpassed those of all previous years by a substantial margin. This is true of both household and commercial lines.

"Despite chaotic economic conditions abroad, export sales were well maintained, as compared with previous years and export shipments of commercial equipment showed a marked increase."

COPELAND WILL OPEN CONVENTION JAN. 18

MT. CLEMENS, Mich. — Copeland Products, Inc. will hold its seventh annual national convention for distributors and dealers at the Masonic Temple, Detroit, on Jan. 18, and 19, W. D. McElhinny, vice president in charge of sales, announced recently.

It is estimated that between 800 and 900 Copeland dealers from all parts of the country and several foreign countries will attend, Mr. McElhinny stated.

The Book Cadillac hotel has been selected as headquarters for the convention.

"We will also place before the distributor organization the most ambitious and aggressive sales and advertising program that we have ever had," said Mr. McElhinny.

"This plan is based on the 1931 sales records of Copeland which have exceeded all previous years by substantial margins, despite a general recession in business as a whole. It is our object to

(Concluded on Page 4, Column 5)

1932 LEONARD LINE TO BE DISPLAYED AT CHICAGO

CHICAGO—The Leonard Refrigerator Co. will exhibit its full 1932 line of eight electric refrigerators at the fifth annual convention of the National House Furnishing Association to be held here Jan. 10 to 16, inclusive.

The Leonard company will have its line on view in Room 711 of the Stevens Hotel every day during the convention. Representing Leonard will be R. I. Petrie, sales manager, and R. W. McCaskey and B. T. Roe, district sales managers.

HAWAIIAN PIANO CO. TO SELL MAYFLOWERS

HONOLULU, Hawaii — The Thayer Piano Co., of which R. A. Howe is the head, has been selected as Mayflower refrigerator distributor here, according to W. J. Seroy, Pacific Coast manager for Mayflower.

Mr. Seroy, who was in the Islands from Nov. 20 until Dec. 11, was pictured with Mr. Howe in the Honolulu *Star-Bulletin* and the *Honolulu Advertiser* during his stay here.

Promoted

FRANCIS M. CORLISS

Appointed director of General Electric ice cream cabinet sales.

* * *

CORLISS GETS NEW G. E. SALES POSITION

CLEVELAND, Ohio—Francis M. Corliss, an engineer in the product division of the General Electric refrigeration department, will assume duties of ice cream cabinet specialist in charge of sales of all General Electric ice cream cabinets, Jan. 1, it has been announced by Walter E. Landmesser, manager of the commercial division.

Corliss, who is but 30 years of age, becomes the youngest sales executive in the Cleveland organization, an organization which is known for the youthfulness of its senior executives.

The young specialist graduated from the Massachusetts Institute of Technology in 1925 with a degree of bachelor of science, after majoring in electrical engineering. He joined the General Electric Co., Aug. 10 of that year as a student engineer and spent a year and a half in general test work in the Schenectady, N. Y., Pittsfield, Mass., and Philadelphia, Pa., works. During this time he tested everything from the smallest motor to the largest transformer built at that time by the company.

On Jan. 17, 1927, shortly after the General Electric refrigeration depart-

(Concluded on Page 4, Column 4)

GRIGSBY-GRUNOW BUYS COLUMBIA PHONOGRAPH CO.

Majestic Acquires New Factories, Patents, Trademarks

CHICAGO—Acquisition of the Columbia Phonograph Co. of North and South America by the Grigsby-Grunow Co., was announced Dec. 24. Voting trustees of the Columbia Graphophone Co. issued a statement saying that they had decided to sell to Grigsby-Grunow Co. all shares of Columbia Graphophone Co., Inc., deposited with them under a voting trust agreement last June.

The announcement was made by B. J. Grigsby, president of Grigsby-Grunow Co., and H. C. Cox, president of Columbia.

This action, it was stated, would give control of the Columbia organization to

(Concluded on Page 4, Column 4)

F-12

Eagerly awaited information on dichlorodifluoromethane, the new refrigerant commonly known as F-12, is supplied in great detail in the Engineering Section of this issue.

The authoritative data on this refrigerant published in this issue was obtained as a result of comparative tests made on many common refrigerants by the Jackson Laboratory of E. I. du Pont de Nemours and Co., Inc., for Kinetic Chemicals, Inc., manufacturer of F-12. Also included in this issue is a report on F-12 made by the Underwriters' Laboratories.

Seven full pages are required to present this valuable and much sought information to the industry

Range Chief

GEORGE A. HUGHES

President of G. E. Edison Appliance, plans 1932 Hotpoint drive.

JAMES & CO. SIGNS G. E. RANGE CONTRACT

ST. LOUIS—James & Co., Inc., General Electric refrigerator distributor here, has recently taken over the distributorship for General Electric Hotpoint ranges. Territory on ranges covered by the James organization will be the same as that which it has been cultivating on refrigeration.

In order to handle the newly added product, the company will add to its wholesale department, according to L. D. James, president.

In the six retail stores, Mr. James believes it will be necessary to build a parallel retail sales organization to handle the range. This is, however, only tentatively planned.

Plan Range Drive

CLEVELAND, Dec. 28—Members of the Joint Committee of the N.E.L.A. and the N.E.M.A. on the Range Plan, met at the Electrical League headquarters, here, today to discuss ways and means of promoting the sales of electric ranges during 1932.

Representing the N.E.M.A. were Reese

(Concluded on Page 4, Column 5)

Aw Gee! I Won

Several hundred persons who packed the Frigidaire Retail Store in Dayton, to hear the winner of a W-6 household model announced, cheered lustily when Robert Smith, 11-year-old youth, who had been saving his pennies to buy his sick mother a Christmas present, was awarded the Frigidaire. E. E. Hagerman, city finance director (left); Frank B. Ramby, fire chief, and Rudolph Wurstner, police chief, found the boy had guessed the exact total.

SPARTON UNITS TO MAKE DEBUT AT CONVENTION

Distributors Will Meet Jan. 4 to See New Refrigerators

JACKSON, Mich.—A line of Sparton electric refrigerators which will be built by the Sparks-Withington Co., manufacturers of Sparton radios and automobile horns, will be introduced at the annual meeting of distributors and dealers of Sparton radios to be held at the factory here Jan. 4 and 5, company officials have announced.

The refrigeration manufacturing processes will be carried on in Sparks-Withington plant No. 4, in which the "White Frost" refrigerator was once manufactured.

Some 50 distributors and between 800 and 900 dealers are expected at the meeting. The distribution of the refrigerators will be handled through the distributor-dealer set-up which now handles other Sparton products, according to Guy C. Core, advertising manager for the refrigeration division.

A separate division is being organized to handle the sale of refrigerators, Mr. Core states. Earl R. Brower is the sales manager of the new refrigeration division. Harry D. Sparks, vice president in charge of sales, will supervise the sales work.

The United States Advertising Corp. of Toledo, Ohio, will handle the advertising account, Mr. Core has announced.

HOROWITZ MANAGES EXPORTS FOR GIBSON

CHICAGO—Charles I. Horowitz has been appointed export manager of the Gibson Electric Refrigerator Corp., Greenville, Mich., with headquarters at 201 N. Wells St., here.

Mr. Horowitz was, for more than 20 years, export manager of the wholesale hardware house of Hibbard, Spencer, Bartlett & Co., during which time he traveled abroad and in Latin America in opening up territories.

He is one of the founders of the Export Managers Club of Chicago, and is a member of the trade advisor panel of the National Foreign Trade Council.

Mr. Horowitz has thus far secured distributors for Gibson refrigerators in Hawaii, France, and Switzerland, and is contacting firms in other countries.

WESTINGHOUSE CONTEST WINNERS ORGANIZE CLUB

MANSFIELD, Ohio, Dec. 29—Banners reading, "Welcome to Mansfield," greeted the nine district winners of the Westinghouse "On-to-Mansfield" selling expedition, as they arrived today for a two-day meeting as guests of the Westinghouse Electric & Mfg. Co.

All expenses paid, the winners were routed on the same train wherever possible, since "surprises awaited them from the time they stepped on the train," according to advance announcements.

City and Westinghouse officials met them at the train, and they were photographed by Mansfield papers. Parties and receptions are planned to fill the two days in celebration of the successful ending of the "expedition."

The nine men, who will be the charter members of the Westinghouse salesmen's honorary club which will be named and organized during the two-day session, are: Allen Black, of Allen-Ingraham, New York, district 1, with a mileage of 22,262; C. B. Harding, Electric Device Co., Springfield, Mass., district 2, with 22,470 miles; Grover Goodman, of Howe & Rogers, Rochester, N. Y., district 3, with 8,970 miles.

J. L. Mullen, of the Van Zandt Sup-

(Concluded on Page 4, Column 5)

SEEGER OPENS NEW OFFICE SHOWROOM IN BOSTON

BOSTON—Seeger Refrigerator Co. announces that its offices and showroom will be located at 644 Beacon St., at Kenmore Square, on and after Jan. 1

MANUFACTURED GAS REVENUES DECREASE

NEW YORK—A decrease of 2.3 per cent in manufactured gas revenues and a decrease of 6.9 per cent in natural gas revenues are reported for the first 10 months of 1931, as compared with the same period in 1930, in a survey covering 90 per cent of the utility concerns which distribute gas, according to Paul Ryan, chief statistician of the American Gas Association.

The manufactured gas companies reported revenues of $314,191,940 for the 10-month period, as compared with $321,654,799, for the same period last year. This revenue came from the sale of 292,992,851,000 cu. ft. of gas in the first 10 months of 1931.

Sales of natural gas reported for the same period brought revenues of $223,114,455, representing the distribution of 549,985,192,000 cu. ft. of gas. This compares with 605,192,164,000 cu. ft. sold in the same period of 1930.

In New England, manufactured gas sales for the 10-month period were up ½ per cent, the result in large part of a gain of some 20 per cent in sales of gas for house heating purposes during the period.

In the Middle Atlantic states, comprising New Jersey, New York, and Pennsylvania, sales for the first 10 months of 1931 totaled 120,721,966,000, substantially the same figure sold in 1930.

In the area embracing Illinois, Indiana, Michigan, Ohio and Wisconsin, manufactured gas sales were down 7 per cent for the 10-month period, the result in part of a drop of 15 per cent in sales of gas for industrial-commercial uses.

VISITS LEONARD PLANT

DETROIT—A. M. Cronin, Sr., Leonard distributor at Portland, Ore., visited Leonard headquarters, here, Dec. 15.

Norge Kings on the Ice

The New York Norge skating team, composed of a group of Eastern champions, has already won or been placed in approximately 40 races this season. From left to right, they are as follows: (back row), Junior Davin, Roy Milne, Herbert A. Brennan, president of World Utilities Corp., Bill Casey, Capt. George Downey, Charles Karwelies; (front row), Tommy Coon, Dorothy Brennan, mascot.

PORTLAND BUREAU TO MAKE SPRING PLANS

PORTLAND, Ore.—The Electric Refrigeration Bureau, here, expects to meet soon for discussion of plans for a joint exhibit in the early Spring.

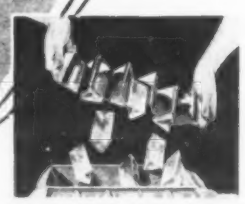
SEATTLE DISTRIBUTOR CHANGES NAME

SEATTLE, Wash.—The Commercial Refrigeration Sales & Service Co. of Seattle, capitalized at $25,000, has changed its name to Jim Canny's.

Equip Every Refrigerator You Sell With One or More

Easy-Out

ALL-METAL TWIN ICE TRAYS



No water is needed to remove the ice from the Easy-Out. Just press down sharply on ends of grid. Lift out the grid and twist or flex it. If an abnormal freezing condition occurs, a dash of water on back of tray produces immediate results.

FREE ELECTRIC FLASHER

This automatic salesman and demonstrator will help you sell Easy-Outs when put in your show window or on your front counter. It's FREE to all dealers who order a supply of Easy-Outs. Send for yours today!

Believe it or not, it is actually easier to sell a refrigerator equipped with one or more Easy-Outs. No customer would ever question the $2.00 or $2.50 extra per tray—most customers would not even know of the extra charge, because you can include it in the delivered price of the unit.

That's the easiest way to sell Easy-Outs. And that's the way to make the welcome 40% extra profit on this popular accessory. The very fact that you have Easy-Outs in every unit you sell gives you an added sales advantage over competitive dealers who do not feature such equipment.

Your service men can sell Easy-Outs, too. Have them carry a supply on every service call. Many a refrigerator dealer is getting back a large share of his service costs by selling Easy-Outs through his service men. And if you let the service men share in the profits, they will sell them—our dealers tell us they are always on their toes, ready to earn a little extra money by selling Easy-Outs for you.

If you do not have a supply of Easy-Outs in stock, send in a trial order today. Put them in the refrigerators on your showroom floor—let your service men sell them on every call.

Then at the end of 1932 take a look at the way the extra profits have mounted up!

REFRIGERATION ACCESSORIES DEPARTMENT OF **McCORD** RADIATOR & MFG. CO. DETROIT, MICH.

HOME JOURNAL EDITOR ON G. E. PROGRAM JAN. 8

CLEVELAND, Ohio—More than 20,000,000 American women will listen Friday noon, E. S. T., Jan. 8, to a coast-to-coast broadcast by Loring A. Schuler, editor of the *Ladies' Home Journal*, when he will explain the now internationally adopted, "It's up to the Women," platform.

This plan which is a program of spending and saving that will contribute largely to bring about the return of normal conditions in business and employment, has gained the enthusiastic approval and reception of thousands of women's club leaders throughout the nation and has been recommended without qualification by the American Economists Committee for Women's Activities.

This committee is headed by Warren M. Persons, consulting economist and former professor of economics at Harvard University.

Editor Schuler's talk will take the spot on the National Broadcasting Co.'s red network usually occupied by the General Electric Home Circle. The General Electric refrigeration department, to which Friday programs have been allotted, will sponsor Editor Schuler's talk as its gesture to aid this campaign.

11 ADDED TO PERSONNEL OF CUSHMAN DEPARTMENT

CLEVELAND—The electrical appliance department, recently opened by the Cushman Refrigeration Co., has added 11 men to its personnel.

The original sales personnel consisted of C. Cross, C. H. Mapes, M. W. McEntire and Keith Ranney.

Charles D. Cellic, D. E. Ingram, J. B. Knapp, Robert Lovitz, David Strong, Albert Luxford, Herbert McCormick, W. F. Prediux, J. M. Robinson, Roy Steward and Ray Keeter have just been added to the appliance sales organization.

Mr. Cellic has come to Cleveland from South Africa, where he is connected with the International General Electric Co.

LOUISVILLE NEWSPAPER SPONSORS GIFT CONTEST

LOUISVILLE, Ky.—The Louisville *Courier Journal* and *Times* sponsored an electrical Christmas gift contest, with prizes amounting to $100 for the best letters telling, "What Electrical Gift You Want for Christmas and Why."

Entry blanks were obtained from any one of 24 firms selling electrical appliances.

NORGE SALESMEN SCHOOL HELD IN BALTIMORE

BALTIMORE, Md.—A Norge retail salesmen's sales school has just been opened in Washington under auspices of Columbia Wholesalers, Inc., 32 S. Paca St., here.

The school has an enrollment of 20. L. L. Andrews is president of Columbia Wholesalers, Inc.

PHILADELPHIA ELECTROLUX SALES GAIN 300%

PHILADELPHIA—C. R. Logan, in charge of refrigerator sales for the Philadelphia Gas Works Co., local distributor for Electrolux, reports a 1931 sales volume of more than 300 per cent of the business transacted in 1930.

APPLIANCE PROGRAM WORKS IN OKLAHOMA

OKLAHOMA CITY—Since the Oklahoma legislature enacted a law prohibiting utility companies from selling electric appliances, a few months ago, utility companies, under the leadership of J. F. Owens, president and general manager of the Oklahoma Gas & Electric Co., and president of the National Electric Light Association, have worked out a cooperative program to increase appliance sales.

The Oklahoma Gas & Electric Co., now has a sales aid department to assist dealers, and has granted the use of its home economics department throughout the state for demonstration purposes.

Sponsored State Fair Display

The company sponsored electric refrigeration displays at the state fair, at a better homes show in one of the new real estate additions, and at the opening of a new market.

It has also cleared the main display floor in its building at Third St. and Harvey Ave. for dealers' use. One kind of product is exhibited at a time; radios are there now, and in the Spring electric refrigerators will form the display. No sales are made from this floor.

Furnish Institutional Advertising

Institutional advertising in newspapers throughout the state is furnished by the utility company.

At El Reno, Okla., the company has a large display room for electrical appliances of all kinds. A captive balloon is attached to the building to attract attention to the display.

During the month of November, the company conducted a "Chase Gloom" campaign which resulted in the sale of 186,000 light globes.

Through its home economics and sales departments, the utility company recently held a two-day school for more than 50 girls from 25 to 30 towns for demonstrations on the sale and care of appliances. These girls were all employed in the sales departments of stores selling appliances.

BALTIMORE WHOLESALERS DISTRIBUTE LEONARD LINE

BALTIMORE, Md.—Southern Wholesalers, Inc., Atwater Kent radio distributor in the Washington and Baltimore territory have been appointed distributor in that territory for Leonard electric refrigerators.

The territory embraces the District of Columbia, the principal city of which is Washington, parts of Virginia and West Virginia, and Maryland.

Southern Wholesalers, Inc., headed by William E. O'Connor, president and treasurer, and F. C. Ferber, vice president and secretary, has headquarters at 1519-1521 L. St. N. W., Washington, D. C., and at 1501 Guilford Ave., under the management of Robert B. Green.

1932 REFRIGERATION PLAN BOOK READY IN JANUARY

NEW YORK—"Another Million in 1932," is the title of the plan book of the second year of Electric Refrigeration Bureau activity, which will be ready for distribution early in January.

This is the first of the two 1932 plan books, and covers the plans for the whole year, with emphasis on the first seven months. A second book will be issued on or about Aug. 1.

The first booklet illustrated in four colors, describes the new promotional material, data on bureau organization and activity in localities of varying population during 1931, a time-table of events, and discussions of the four special sales periods.

ENDRESS OPENS FRIGIDAIRE STORE IN BIRMINGHAM

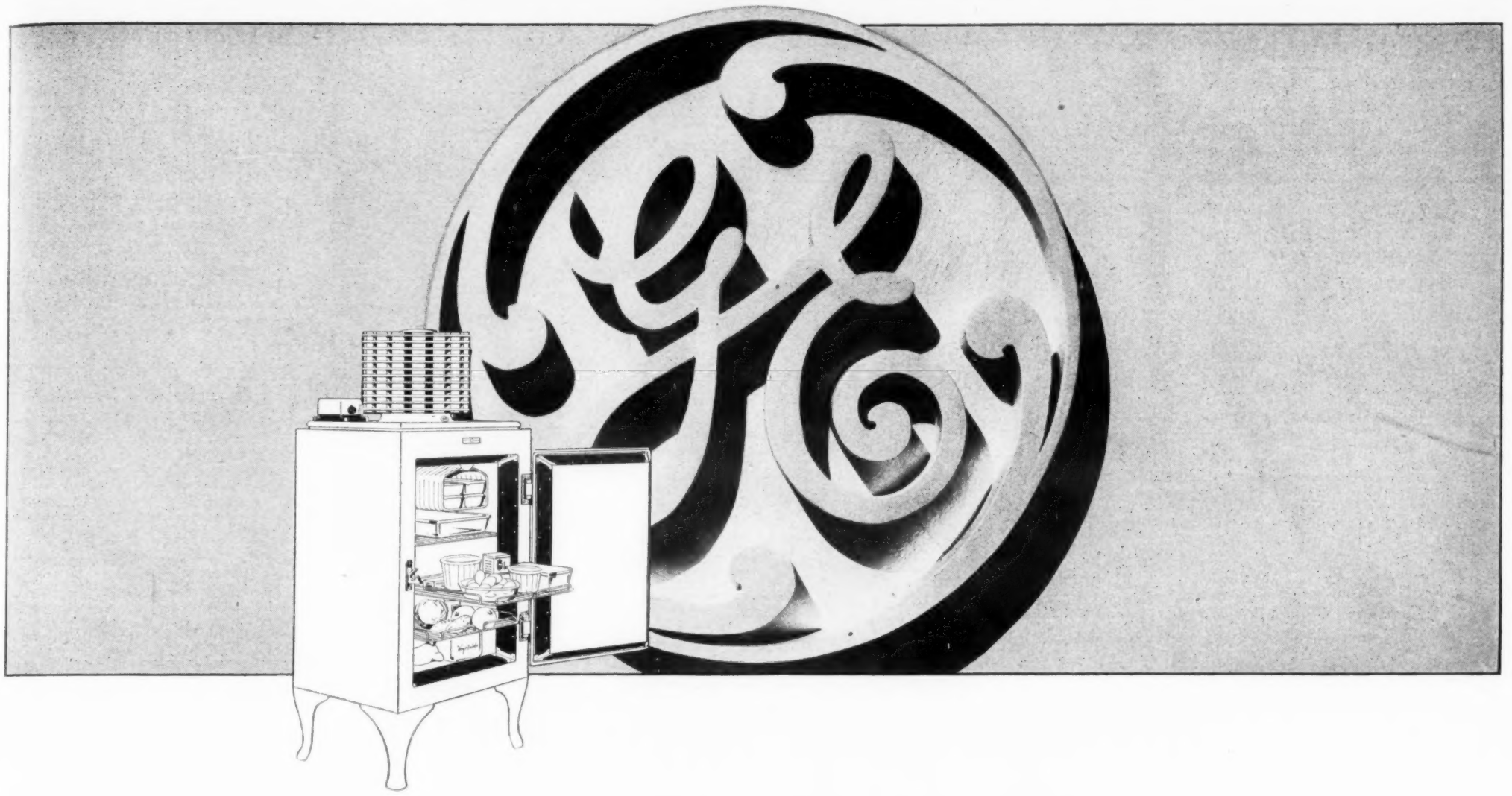
BIRMINGHAM, Ala. — Frigidaire's newest southern showroom opened here recently with an "open house" for homemakers. The new showroom and sales organization are being directed by Otto C. Endress, who came here recently from the home offices of Frigidaire Corp. at Dayton, Ohio.

In opening up a factory branch, Frigidaire took over the Domestic Electric Co., which was operated by W. C. Knoupf as local representative of the factory.

REFRIGERATION FEATURED IN APPLIANCE SHOW

NEW YORK — The Homemakers' Christmas Market, here, devoted two days to teaching metropolitan housewives the value of electric appliances; electric refrigerators were featured during those days.

Miss Jeanne Adaire, of the Frigidaire Corp., was a speaker on the program, of the New York Edison Co.



PROFITS

ALL YEAR · · · EVERY YEAR!

EVEN in 1931—ninety-seven out of every one hundred dealers handling General Electric refrigerators have found it a profitable undertaking.

Product performance, and product performance alone, is responsible for this record. The All-Steel cabinet is built for life-time service. The simple G-E mechanism is all hermetically sealed-in-steel in the Monitor Top. There's nothing to require attention—not even oiling.

Greater NET profits result from such performance. Good will is won with every sale—good will that makes more prospects, more customers. Every General Electric user is an enthusiastic salesman for the Monitor Top—telling friends and neighbors about its unfailing dependability and complete freedom from servicing. This unparalleled performance record, made in more than a million homes has spelled consistently increasing net profits to General Electric dealers everywhere.

GENERAL ELECTRIC SALES FEATURES

- THE MONITOR TOP, containing all the simple, current-saving mechanism, hermetically sealed-in-steel, requiring no attention—not even oiling.
- ALL-STEEL CABINET, built like a safe to give year after year of trouble-free service.
- SLIDING SHELVES, to bring all food in plain sight and easy reach—a General Electric development.
- SANITARY SUPER-FREEZER, made entirely of porcelain; open, easy to clean and to keep clean. Acid-resisting porcelain interiors on all models.
- 3-YEAR GUARANTEE, a complete warranty against any service expense whatever for 3 full years, backed by all the vast resources of the General Electric Company.

General Electric Company, Electric Refrigeration Department, Section DF 123, 1400 Euclid Avenue, Cleveland, Ohio

GENERAL ELECTRIC

ALL-STEEL REFRIGERATOR

DOMESTIC, APARTMENT HOUSE AND COMMERCIAL REFRIGERATORS—ELECTRIC WATER COOLERS

HARRISON ENTERTAINS 300 STAFF MEMBERS

NEWARK, N. J., Dec. 29—With an attendance topping that of any previous year, the fifth annual dinner party of the Philip H. Harrison organization, held last night at the Newark Athletic Club, celebrated the refrigeration sales record of the organization for the year about to close.

Mr. Harrison, distributor of General Electric refrigerators, here, had more than 300 guests from his own company and affiliated New Jersey and Pennsylvania dealers.

From the Harrison company proper about 230 gathered around tables grouped to form the initials "P. H. H." The 70 guests from independent dealers were served dinner in various private dining rooms. Later in the evening they joined the main group.

Prizes were awarded to the candidates who won their respective posts in connection with the nation-wide G. E. "Refrigerania" drive, as follows: governor, A. B. Judge, manager apartment house sales, from the Harrison company; lieutenant-governor, J. L. Mahoney, commercial sales supervisor, also from Harrison's group; congressman, R. E. Babson, Montclair, N. J., dealer; mayor, S. L. Wentz, commercial salesman, of the Harrison company.

Mr. Harrison made an informal address on "Past Performance and Future Opportunities in Specialty Selling." Representatives from the following control dealers were present: the Elizabeth-Harrison Co., Elizabeth; the Marsh-Harrison Co., Morristown; the Hackensack-Harrison Co., of Hackensack and Englewood; and the Plainfield-Harrison Co., of Plainfield and New Brunswick.

In the independent dealers group were the R. E. Babson Co., Montclair; George S. Hasbrouck, Passaic; Heat & Coal Equipment Co., Paterson; Stanley Stanton, Ridgewood; Walter Wanner, Nutley; Westwood Furniture Co., Westwood; H. Hendrickson Co., Red Bank; and the Morrison Electric Shop, of Easton, Pa.

More than 100 children of the organization attended the fifth annual Kiddies' Christmas Party last Wednesday afternoon at the Harrison branch showroom in East Orange. The story of Christmas was told to an attentive audience. After distribution of the gifts, under a 12-ft. tree, the children were entertained with a Punch and Judy show and motion pictures.

Comfort in the Home Office

Chicago offices of the Ilg Electric Ventilating Co. are conditioned by two overhead Ilg-Kold direct expansion room coolers, operated in connection with a 5-ton methyl chloride compressor.

'32 RANGE CAMPAIGN PLANS ARE DISCUSSED

(*Concluded from Page 1, Column 4*)

Mills, of the Westinghouse Electrical & Mfg. Co.; P. L. Miles, of the Edison General Electric Co.; A. L. Lindeman, of the A. J. Lindeman and Hoverson Co., and A. L. Smith, of the Walker & Pratt Mfg. Co.

N.E.L.A. delegates were Davis M. DeBard, of Stone & Webster, Inc.; Thomas Roach, of the National Electric Power Co.; L. R. Parker, of Commonwealth and Southern; W. H. Hodge, of the Byllesby Engineering and Management Corp.

Advisory members of the Joint Committee present were Leon H. Curtice, of the N.E.M.A. and C. E. Greenwood of the N.E.L.A.

Distributor Signed

SPRINGFIELD, Mass.—Breckenridge, Inc., distributor for General Electric refrigerators in five Massachusetts counties, has just taken on distribution of the General Electric Hotpoint range.

Separate sales organizations have been set up for the two products. John M. Breckenridge, former retail sales manager of the refrigeration division, will have charge of the range division.

O. H. Jensen succeeds him as retail sales manager of refrigeration. R. E. Hannon continues as wholesale manager of that line.

WESTINGHOUSE CONTEST WINNERS ORGANIZE CLUB

(*Concluded from Page 1, Column 5*)

ply Co., Huntington, W. Va., district 4, with 8,910 miles; C. L. Townsend. Clary Tafel-Williams, Chattanooga, Tenn., district 5, with 6,115 miles; H. L. Buehler, of the Danforth Refrigerator Co., Cleveland, with 15,650 miles.

Walter Tieche, Wisconsin Sales of Milwaukee, with 10,335 miles; George Minor, A. R. Lindburg Co., St. Louis, with 22,285 miles, and L. R. Spates, Ruebel Electric Co., Alhambra, Calif., with 7,270 miles.

Mr. Harding had the largest total mileage after a last minute spurt; Mr. Black was the only apartment house salesman among the winners.

CORLISS HEADS G. E. ICE CREAM CABINET DIVISION

(*Concluded from Page 1, Column 2*)

ment was formed, Corliss was transferred to the refrigerator test department as assistant director. In August of the same year, he was transferred to the refrigerating engineer department and placed in charge of examining, rejecting and reporting on returned refrigerators.

Corliss was transferred again, to the product division, in June, 1928, and placed in charge of product educational work. This involved writing the product manual, and directing factory and field product educational courses.

GRIGSBY-GRUNOW ACQUIRES COLUMBIA PHONOGRAPH

(*Concluded from Page 1, Column 3*)

Grigsby-Grunow, as more than 78,000 of the company's outstanding total of 82,524 shares are deposited with the voting trustees.

Columbia Phonograph was formerly an American division of the old Columbia Graphophone Co. of England. Columbia products include radios as well as phonographs and phonograph records. Grigsby-Grunow will acquire all trademarks and patents in North and South America.

The merged company will have plants in Chicago, Bridgeport, Conn., and Los Angeles.

COPELAND CONVENTION OPENS IN DETROIT JAN. 18

(*Concluded from Page 1, Column 1*)

make 1932 show an equal or greater increase. Electric refrigeration has led all other industries in both sales and earnings."

The convention will be in charge of Mr. McElhinny. William Robert Wilson, chairman of the board; Louis Ruthenburg, president, and other Copeland executives will address the convention on subjects that relate to their departments and special interests.

A feature of the convention will be a play, entitled "Shoes," written by Mr. McElhinny.

NATION-WIDE APPROVAL

100% VERTICAL SURFACE

U.S. PATENT No. 1,776,235.

LARKIN COILS

1931 further proves Great Service features of these Coils

AND NOW FOR MORE QUICK, TROUBLE-FREE SALES IN 1932

There's a reason for this NATIONAL ENDORSEMENT

Distributors and dealers, backed by factory tests, later proved by their own satisfactory experiences, have found that the sale of electrical refrigeration is speeded by the use of Larkin 100% Vertical-surface Aluminum Plate Coils, available in 93 standard sizes, adaptable to over 6,000 installation combinations. Over 25,000 Larkin Coil installations in use are proof conclusive of results. Get data—don't be at a selling disadvantage for the 1932 drive.

LARKIN-WARREN REFRIGERATING CORP'N
Originators and Manufacturers ATLANTA, GA.

Copeland DEPENDABLE Refrigeration DETROIT, MICH.
SERVEL COMMERCIAL Electric Refrigeration
WILLIAMS ICE-O-MATIC REFRIGERATION BLOOMINGTON, ILLINOIS
UNIVERSAL DETROIT, MICH.
Zerozone Lifetime Refrigeration
M&E Electric-Automatic REFRIGERATOR PHILADELPHIA
Absopure DETROIT, MICH.
DICELER DESIGNED BY MACHINE CO.
TRUPAR DAYTON, OHIO
B-K, Junior New Brunswick, N.J.
KULAIR PHILADELPHIA, PA.
STARR FREEZE Electric Refrigeration
ELECTRIC RICE REFRIGERATION
Modern
JEWEL Refrigeration
Apex CLEVELAND, O.

Just a Flip of the Finger Brings the Information You Want

• • •

• It's mighty convenient to have back issues of the NEWS available for quick and easy reference. Time and money often can be saved if a permanent file of back copies is handy.

• For the convenience of subscribers, ELECTRIC REFRIGERATION NEWS offers a neat, easily "workable," and good-looking binder. Individual issues of the paper are inserted by means of metal retaining strips—39 with each binder. The paper is secured without "pinching," so that each page lies flat and is easily readable.

• Durable and good quality black imitation leather is used for the stiff covers. "ELECTRIC REFRIGERATION NEWS" is neatly stamped in gold on the top cover and on the back edge of the binders.

• Make it easy to find what you want, when you want it. Buy a binder!

• Shipped postpaid upon receipt of $3.75.

• ■ •

Electric Refrigeration News
550 Maccabees Bldg., Detroit

Your Test of Insulation will be Checked in HER Kitchen

An open letter to manufacturers of good electric refrigerators:

"IT WILL NOT be difficult for your engineers to lay before you carefully worked out data on the performance of your refrigerator. Check over with them the figures on operating time, food preservation efficiency, heat absorption and production costs. Study with your sales department all the details of advertising, sales activities, dealer organization, prices and discounts.

"But bear this in mind—the final test of the success of your refrigerator is made without your consent, without your control, and without any chance of your defense. It is made in the court of last appeal—the kitchen of the buyer—far from your factory, your laboratory, your sales manager, your own office chair.

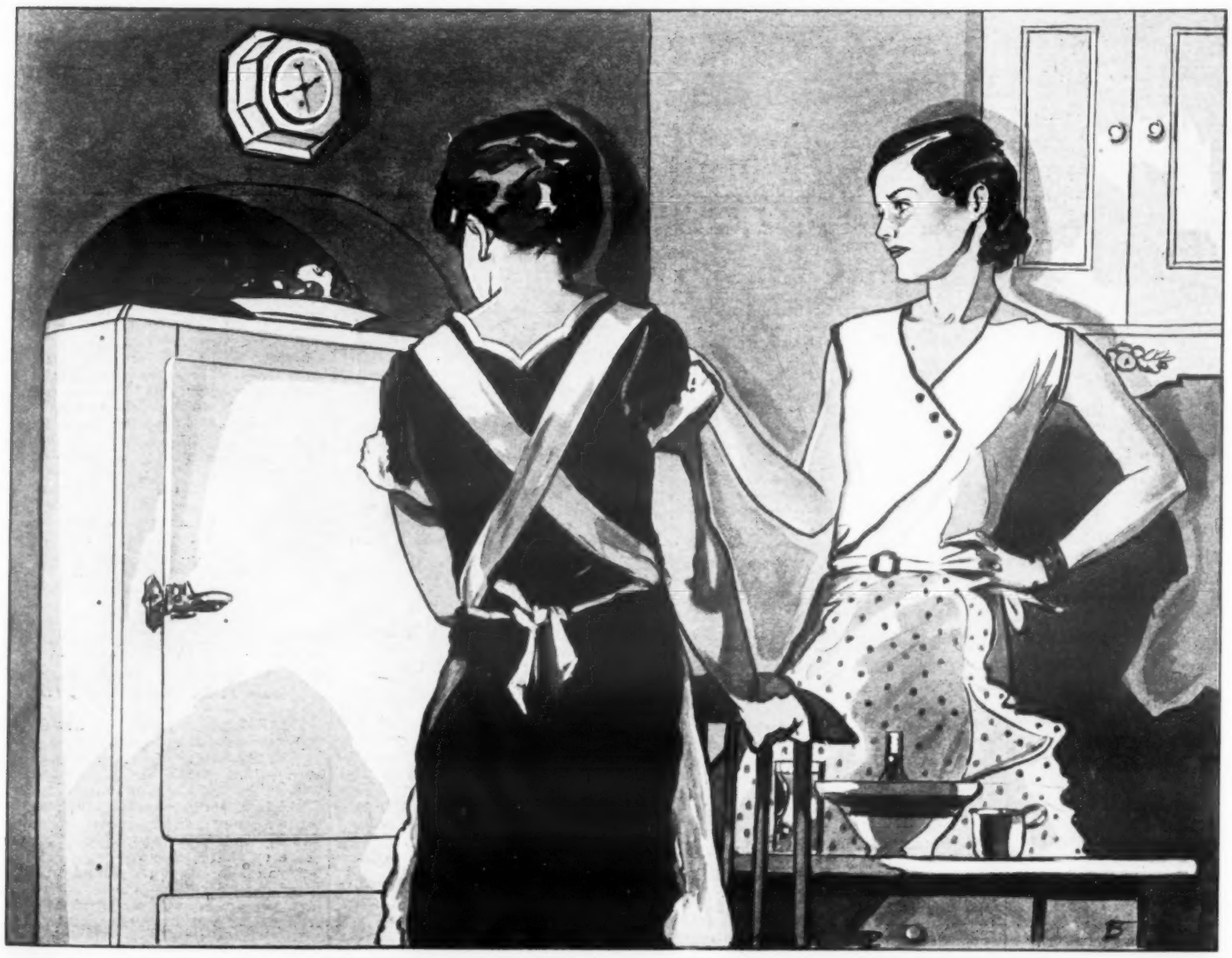
"The refrigerator door will slam shut, the motor will whir, the compressor will pulsate silently, and a meter will whiz round in some dark corner of the basement. All as you have expected. And then the seasons will roll past and the months will speed by. What will the housewife think of results?

"The answer to that question—and that answer alone determines the future of your career as a manufacturer of refrigerators. Because that answer will be bruited about the community as neighborhood gossip. It will spread throughout the length and breadth of the land. It will make or break more sales for you than any other thing.

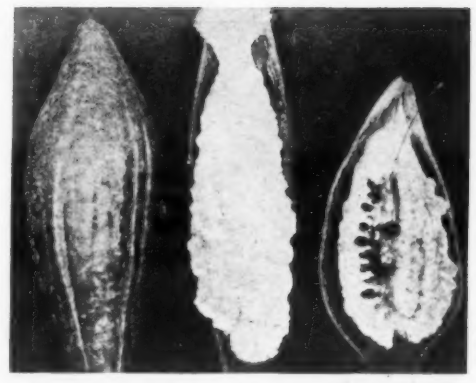
"Remember this when you choose insulation. It is unseen. Its function is a mystery to the housewife. If it fails it will get no blame. The blame will fall on your shoulders. Your refrigerator will be condemned without benefit of counsel.

"So what are you going to do about the insulation in your cabinets? Will you look ahead and use insulation that is sure to stand the test in the kitchen where it's summer all year round?

"Dry-Zero engineers will be glad to explain the safety factor of Dry-Zero Pliable Slab insulation."



"Mother, the refrigerator seems to run an AWFUL lot, doesn't in?"



The pod of the tropical Ceiba tree from which Dry-Zero is made.

Facts about Dry-Zero

Dry-Zero is made from the fibres of the huge seed pods of the Ceiba tree growing in Java and the South Sea Islands. Nature designed these fibres to carry seeds for long distances through humid air and tropical showers. To do this it was necessary that they be light and completely resistant to moisture.

By an ingenious process of "graining" the fibres are laid parallel with each other, and at right angles to the line of heat flow. This results in greatly increasing the resistance to heat movement through the minutely uniform batt thus formed.

For use in refrigerators, the Dry-Zero batt is placed in treated fibre-board containers made exactly to fit a specified position in the refrigerator. These sizes are carefully checked by templates to assure perfect fitting, although the flexibility of the slab allows for common irregularities of cabinet construction.

The slabs are completely wrapped in a special Kraft paper which has been thoroughly coated with an asphalt made specifically for Dry-Zero and rolled on under heat and pressure. This results in the Dry-Zero Sealed Slab which has the most perfect vapor seal that has been developed in the insulation industry.

Where cabinet construction permits, the outer Dry-Zero sealing sheet extends beyond all sides of the slab providing the exclusive vapor tight sealing flange.

The U. S. Bureau of Standards has published the conductivities of various insulating materials. In this table the efficiency of Dry-Zero insulation is found to be from 12½% to 40% higher than the other refrigerator insulating materials. Bear in mind that these figures are authentic and not the claims of manufacturers.

In other tests, for moisture absorption, notably by Prof. Miller of the University of Minnesota, Dry-Zero has been shown to absorb a far smaller quantity of moisture than any of the other leading materials. Further, as moisture will inevitably penetrate any refrigerator wall in time, it is well to know that it will have practically no effect on Dry-Zero which is unique in this respect.

Its use in thousands of domestic refrigerators, ice cream cabinets, solid CO_2 containers, railroad refrigerator cars and refrigerated trucks over a long period has proved beyond doubt the permanence and dependability of Dry-Zero.

DRY-ZERO CORPORATION
Merchandise Mart - Chicago, Illinois
Canadian Office - 465 Parliament St., Toronto

THE MOST EFFICIENT COMMERCIAL INSULANT KNOWN

DRY·ZERO

AMAT-ICE ANNOUNCES 1932 AUSTRALIA LINE

SYDNEY, Australia — Announcement of the 1932 line of Amat-Ice electric refrigerators, manufactured by the General Refrigerating Co., here, has been made by Louis R. Bedell, manager of the company.

The name Amat-Ice, coined from the initial letters of "Australian Made for Australian Trade" is the trade name of electric refrigerating equipment made by this firm, which has been in the refrigeration business for 20 years.

The 1932 folder shows six of the Amat-Ice household models, in both DeLuxe and standard designs. The commercial units pictured include those for ice cream service and manufacture, soda fountains, ice cream cabinets, water coolers, ice block makers, milk coolers, walk-in coolers, show cases, cabinets for shops, hotels, institutions, etc.

The company produces more than 30 refrigerator units, in air and water cooled condensing types, and manufactures cooling coils in practically every variety. The company also makes its own cabinets.

Herr Einstein Writes Of His New Unit

Time from his mathematical contemplation of the laws of the universe was taken recently by Prof. Albert Einstein in the workroom of his home at Potsdam, Germany, to pen a letter to Berlin Frigidaire officials on the pleasure he received from his new Frigidaire.

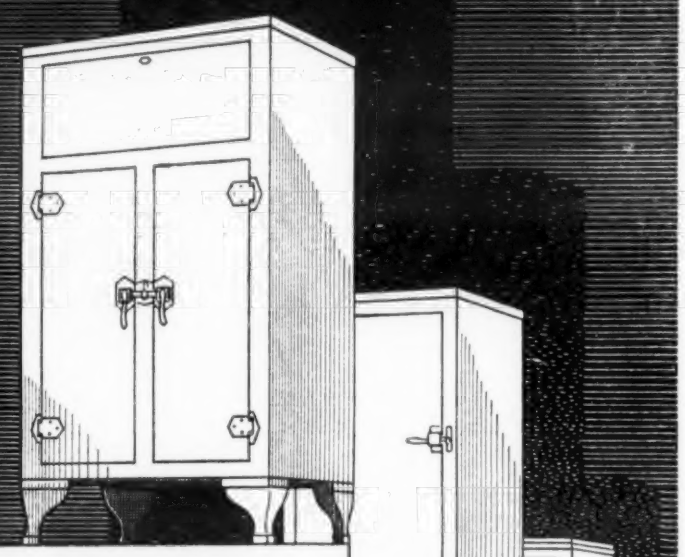
Writes Herr Einstein:

"The fully automatic method of operation brings about a current consumption in comparison to the outside temperature whereby automatically an economic usage is assured."

FRIGIDAIRE DEALER MOVES TO NEW QUARTERS

ANDERSON, Ind.—Rogers Electric Co., dealer in Frigidaire refrigerators, has moved into new quarters at Eleventh and Main Sts., here. Glenn Rogers is president of the company.

CABINETS



ACCURATELY MADE . . . .

Delivered on Schedule

THE most modern equipment for every operation enables us to manufacture any type or style of cabinet best suited to your mechanical unit. And plenty of this equipment—plus a manufacturing personnel backed by over 37 years' experience in the manufacture of refrigerator cabinets—insure delivery of cabinets right on schedule!

A capable engineering staff is also at your disposal. They will gladly work from your own rough ideas or in conjunction with your own staff.

Whatever the size of your needs, we will welcome the opportunity to give you more complete information.

Refrigerator Division

TENNESSEE FURNITURE CORPORATION

CHATTANOOGA, TENNESSEE

DISTRIBUTORSHIPS for the complete Cavalier Electric Refrigerator are still open in a few sections. Handsome new cabinets . . . . a host of convenient features . . . . remarkably low prices . . . make the Cavalier easy to sell. Simplicity of operation and surprising freedom from repairs reduce dealer service overhead to a minimum. Write for complete information—today.

Back from Gay Paree

"WE HAD TO SEE PARIS," said these two gentlemen, R. D. Pike, sales manager for Rochester Gas & Electric Co., and T. E. Parr, Servel Commercial service representative, aboard the S. S. President Roosevelt recently, returning from a vacation in the French capital.

'Where Can I Buy Frigidaire, Electrolux?' Asked Of R. H. Donnelly Buyers' Service

Reprinted from *Advertising & Selling*, Dec. 9, 1931.

In connection with our business, we have what we term a "Buyers' Service." We have two such bureaus, one in New York and one in Chicago. In each are six girls at telephones who do nothing all day but direct the prospective purchaser to the willing seller. They average together 60,000 telephone calls a year. In addition, they receive literally thousands of letters from all over the globe—all asking one question: 'Where can I buy this?"

You might suppose that the majority of such requests would be for queer gadgets and rare commodities, but strange to state, these requests are in the minority.

Of course we do receive requests for such strange things as "the Chinese substitute for meat"—"pea-splitting machinery" and other oddities of commerce, but in the vast majority of cases, information is requested for every-day, nationally advertised products.

In the past three weeks, for example, we have had requests for the following:

Chevrolet Motor Cars
Fleischman's Yeast
Maxwell House Coffee
Pepsodent
Philco Radio
Campbell's Soup
Frigidaire
Electrolux
Remington Typewriter
American Radiators
Minneapolis Heat Regulators
May Oil Burners
Martex Towels
Multigraph Machines
Blackstone Cigars
Plymouth Cars
Betty Wales Dresses
Cellophane
Murphy Auto Varnish, etc.

Inquiries for some of these commodities would seem to indicate that the buyer must be blind and deaf or recently arrived from Mars. On closer investigation, however, we find that a great many of those who call us are retail merchants who don't know where they can buy a supply of the commodity asked for.

Just what the answer is, I am not prepared to say. How to go about emphasizing local contacts—making the name of the jobber easier to find—telling both the retailer and consumer where to find what you have to sell—opens the door to many apparent solutions. Perhaps a more intensive newspaper campaign would help. Local mailing campaigns, posters, car cards—a great many things suggest themselves, and, of course, a proper listing in the local Classified Telephone Directory will lead almost everyone to the dealer who sells what they want.

But what I started out to prove was not so much the solution to the problem as to demonstrate the futility of the opinion "Everybody knows me."

KARL KNIPE,
The Reuben H. Donnelly Corp.,
New York.

NEW ZEALAND DISTRIBUTOR VISITS KELVINATOR PLANT

DETROIT—Albert Russell, sales manager and member of the board of directors of James J. Niven & Co., Ltd., Kelvinator distributor at Wellington, New Zealand, visited the Kelvinator factory early in December for a conference with E. H. Wilcox, manager of the export division.

Mr. Russell was on his way to New York, where he planned to sail for England for a long stay. He will visit Kelvinator again en route back to New Zealand.

INDIANA G. E. DEALERS OPEN NEW STORES

INDIANAPOLIS—Two dealers for the Hoosier Electric Refrigerator Co., General Electric refrigerator distributor, here, recently opened new stores.

They are the Scott Electric Co., Crawfordsville, Ind., and the Hall Electric Co., Bloomington, Ind.

BY-LAWS ARE DRAWN BY KNOXVILLE BUREAU

KNOXVILLE, Tenn.—A set of by-laws adopted by the electric refrigeration bureau of Knoxville is recommended by W. H. McInnis, secretary of the Knoxville bureau, to any locality considering the formation of an electric refrigeration bureau.

The by-laws follow:

Article I. The name of this organization shall be: The Knoxville Electric Refrigeration Bureau.

Article II. 1. The purpose of this organization shall be: To promote a better understanding among the dealers in electric refrigeration in the City of Knoxville.

2. To work out and adopt policies of conducting the electric refrigeration business, which shall be to the best interests of the customers and dealers.

Article III. 1. The membership of this organization shall be confined to retailers and distributors handling electric refrigerators known to be the product of a reliable manufacturer.

2. The membership shall be further limited to retailers and distributors who have a store or warehouse where electric refrigerators can be displayed to the public or the trade.

3. All members of the bureau, besides charter members, shall be admitted through ballot, a majority vote of all members being necessary to elect.

Article IV. 1. The officers of this bureau shall consist of: (1), a chairman; (2), a vice chairman; (3), a secretary

2. The duties of the chairman shall be those which usually devolve upon an officer of this character. In the absence of the chairman, the vice chairman shall assume the duties of the chairman.

3. The duties of the secretary shall be to keep minutes of all meetings of the bureau, to send out bulletins and notices of meetings to members and to perform such other duties as the chairman may direct.

4. The officers shall be elected by a majority vote of the membership.

5. The term of office shall be for a period of one year.

6. The officers shall be elected at the meeting at which these by-laws are adopted, and every twelve months thereafter.

7. Representatives of —— firms shall constitute a quorum at any regular or special meeting.

8. Each member firm or organization shall be entitled to one vote.

Article V. 1. There shall be no initiation fee and no dues attached to membership in this bureau.

2. The bureau shall be operated and conducted as a non-profit organization.

Article VI. 1. Regular meetings shall be held once each month at a date to be determined by the chairman. Special meetings may be called at any time at the discretion of the chairman. The chairman shall call a meeting at any time at the request of five or more members.

2. The secretary shall notify each member in advance of the date of the meeting.

Article VII. 1. Any member who may wish to do so, shall have the privilege of resigning his membership in this bureau, by giving written notice to the secretary of his desire to withdraw.

2. Any member firm not represented at four consecutive regular meetings without acceptable reasons, shall be automatically dropped from membership.

Article VIII. Any member who, in the opinion of a majority of the other members does not conduct his business according to the policies which may have been adopted by this bureau, and who after having the matter called to his attention continues to violate these policies, may be expelled by a two-thirds vote of the membership. All charges against any member, if any, shall be preferred in open meeting and an opportunity shall be given him to defend himself before the members.

Article IX. This bureau may be dissolved by a two-thirds vote of the members.

WESTINGHOUSE GIVEN AT TERRE HAUTE, IND., PARTY

TERRE HAUTE, Ind.—A new Westinghouse electric refrigerator was given free to the holder of the winning ticket at a public euchre and pinochle given Dec. 29, by the Kerman Patrol.

The refrigerator was on display on one of the downtown streets where tickets were sold, each good for one share on the refrigerator.

A salesman from the Standard Electric Sales Co., 1232 Wabash Ave., Westinghouse dealer, was stationed with the refrigerator and invited prospective customers to visit the salesrooms.

FRIGIDAIRE DEALER USES METER-ICE PLAN

ROCHESTER, N. Y.—Gilbert Utilities Corp., East Ave. at Alexander St., Frigidaire dealers, have introduced the Meter-Ice plan of purchasing refrigerators.

Profits in 1932...

AND FOR YEARS TO COME

START the New Year — profitably! Find out about SERVEL Commercial Electric Refrigeration.

Here's a complete line of 16 powerful, improved machine units for every commercial need. Stronger, sturdier — they embody exclusive advancements that make them easier to sell — simpler to install

SERVEL Commercial Dealers enjoyed a prosperous year in 1931. Even richer opportunities for increased sales and greater volume lie ahead in 1932.

Do steadily growing year-round profits interest you? Then send for details now. The SERVEL Franchise may be available in your city. Ask for full information about SERVEL'S profitable proposition, without obligating yourself in any way. Write today to Servel Sales, Inc., **Dept. H-10**, Evansville, Ind.

NEW-STYLE CONDENSERS: *Interchangeable—making it possible to convert a water-cooled model into an air-cooled model, or vice versa, to meet any service requirement.*

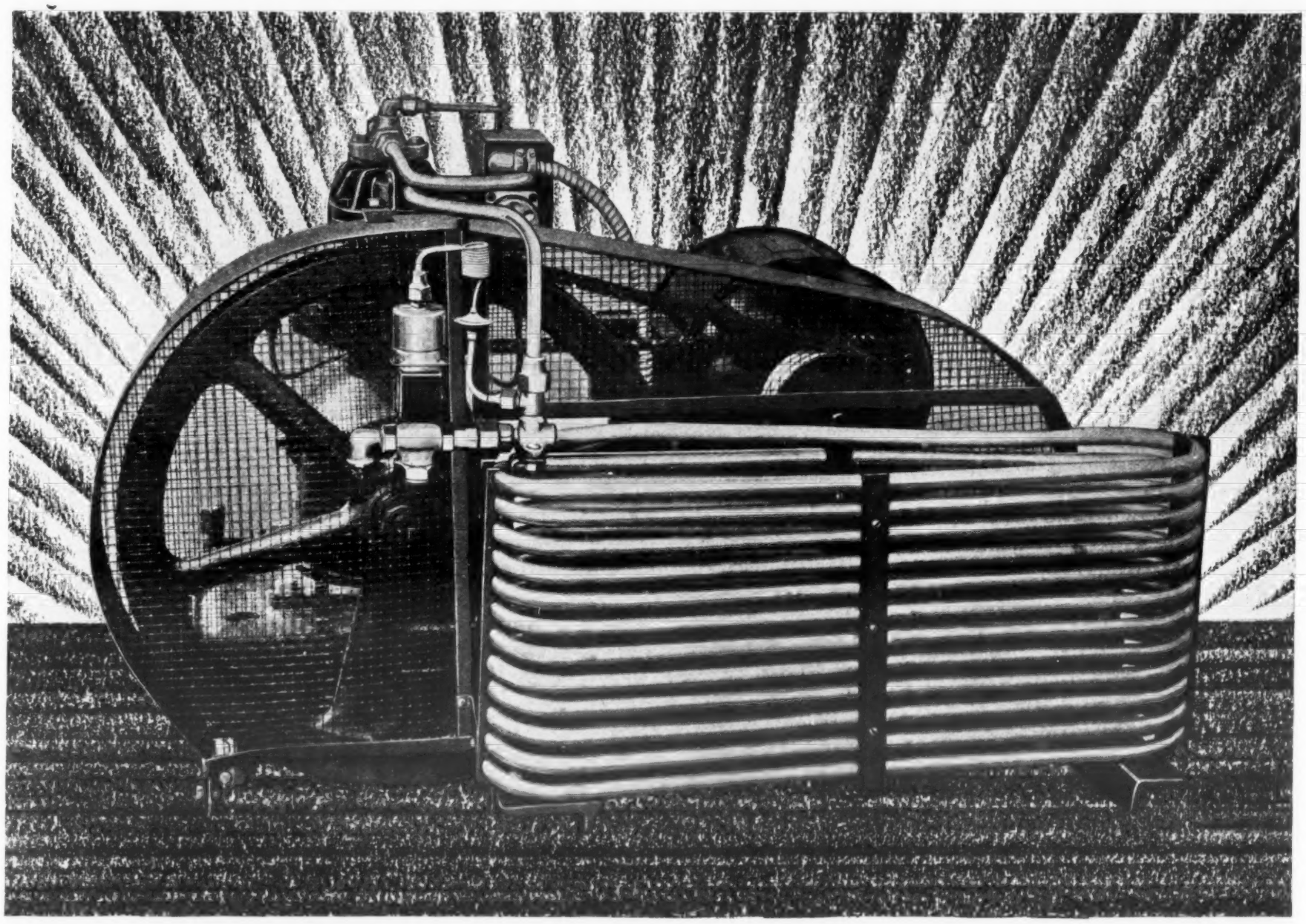
MULTIPLE VEE-BELT DRIVES: *Insuring uninterrupted service and quiet operation.*

SIMPLIFIED CONTROLS: *Fully automatic.*

ECONOMICAL OPERATION: *Low-speed compressors provide greater refrigerating efficiency for minimum current consumption.*

RUGGED PRECISION CONSTRUCTION: *Built for long use; compact and accurate.*

WIDE RANGE OF 16 MODELS: *With capacities of 130 to 1510 lbs. ice equivalent per day.*



SERVEL MODEL 125-AW—*This large water-cooled machine unit has a 24-hour capacity of 1510 lbs. ice equivalent. Powered by a 1½ HP motor and driven by triple Vee-belts, it is completely automatic in operation.*

+ Refrigeration Plus!

...PROFIT WITH SERVEL IN 1932

SERVEL

COMMERCIAL REFRIGERATION

MERCHANDISING SECTION ELECTRIC REFRIGERATION NEWS

The Business Newspaper of the Refrigeration Industry

Published Every Week by

BUSINESS NEWS PUBLISHING CO.

Also publishers of REFRIGERATED FOOD NEWS (monthly) and the REFRIGERATION DIRECTORY (annual)

550 Maccabees Building, Woodward Ave. and Putnam St. Detroit, Michigan. Telephones: Columbia 4242-4243-4244

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Canada: $6.00 per year (U. S. Money)

U. S. and Possessions and countries in Pan-American

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VOL. 6, NO. 17, SERIAL NO. 145, Part 1, Dec. 30, 1931

Vice Versa

AT this time last year manufacturers of electric refrigerators were assiduously seeking to recruit new dealers from the ranks of retailers of radios, oil burners, washing machines, vacuum cleaners, and other home appliances.

The electric refrigerator was described as an excellent companion merchandising product to other devices for the home. It was pointed out that dealers in other appliances could even up their seasonal sales curves by adding a line of electric refrigeration, which had its sales peak in the summer (oil burners sell best in the fall; radios in winter).

Well taken was the appeal, and hundreds of radio and oil burner dealers became electric refrigeration dealers. Some of them learned the business, caught the swing of the industry, and survived. Some learned their lessons so well that their whole operation benefited immensely, and they became merchandisers on a much larger scale (and at a considerably faster pace) than ever before.

Appeal Shifts

At the beginning of 1932 the appeal seems to have shifted. Today it is the manufacturer of electric ranges, the maker of oil burners, or the radio distributing organization, which is seeking to get new dealers from the electric refrigeration industry.

Instead of electric refrigeration being held up as a first-class piece of companion merchandise for other products, the merits of the *other products* are now being extolled as ideal allied lines for electric refrigeration.

Healthy respect for the success of the electric refrigeration industry during the last few years, for its steady forward progress when business was slack in other industries, for its aggressive distributing organizations and its keen merchandising methods, has been responsible for the present attitude of manufacturers of other household appliances.

They Know How

Electric refrigeration dealers and distributors have demonstrated that they know how to move specialty products into homes in quantities and with speed. And having made the demonstration, they may now prepare to listen to overtures from sales representatives for other household lines.

Most aggressive among the manufacturers of other home appliances who are seeking outlets for their goods through electric refrigeration distributors and dealers is the Edison General Electric Co., which is rapidly establishing a brand new distributing set-up by the appointment of General Electric refrigerator distributors as distributors for Hotpoint electric ranges. Electromaster, Inc., manufacturer of Electrochef ranges, is also seeking to get distribution through electric refrigeration sales organizations.

Ranges, Oil Burners

Oil burner manufacturers, too, are preparing to go after electric refrigeration dealers for their own organizations. These manufacturers point out that oil burners and electric refrigerators employ the same general types of small motors, pumps, and automatic starting and stopping devices. They claim that the same service men can handle work on both products readily.

And, as in the case of electric range manufacturers, they point out that their products have been greatly simplified recently, that installation and service have become less complicated, and that like ranges, oil burners have thus become more attractive companion merchandise for the specialty selling organization.

Wise Manufacturers

Manufacturers of companion merchandise are indeed wise in wanting to induce some of these star merchandising organizations to push allied lines. A successful electric refrigerator dealer has, for instance, a tailor-made prospect list of homes, into which he has ready entree because he has sold those homes a satisfactory household appliance.

And because the successful electric refrigerator dealer's intense market cultivation and consistent camping on home doorsteps have enabled him to set new high sales records in spite of the general depression, he is a man who has standing and respect in his community.

More to the point, he probably has excellent display facilities, knows how to advertise effectively, and understands how to sell quality articles to housewives and their husbands. Refrigeration dealers comprise a high type of specialty selling organization which can scarcely be matched for sales-getting potentialties.

Ready to Branch Out

Electric refrigeration manufacturers who, in the past, have been inclined to frown on the idea of their dealers taking on companion lines, now seem satisfied that their organizations are about ready to branch out a bit. They know by this time that these dealers can sell electric refrigerators. They feel confident that it will be difficult for these dealers to slight their efforts on electric refrigeration sales, now that they know what can be done in this field.

They know also that the judicious addition of a companion line might help dealers and distributors reduce overhead and increase the size of their operations—thus making it possible for them to do an even better job with the merchandising of electric refrigerators.

Cause for Pride

Refrigeration sales organizations should take considerable pride in the fact that *they* are the ones who are being sought and cultivated and wooed by appliance manufacturers, instead of themselves being the suitors.

It is an indication not only of their esteem and standing in the community of industry, but of the almost unassailable statement that they have learned how to sell specialty products to homes better than any other group of distributing organizations, and have added the most recent and most studied chapters to the book of specialty salesmanship.

GLEANINGS

FROM RECENT PERIODICALS

IF THERE is any one lesson to be learned from the present depression, it is that those industries which have stood up best and have suffered the least are those which have maintained and are operating on stable price levels.

Just one example; the electrical refrigeration industry. It has enjoyed a brisk, healthy business right up to September of this year. Last year nearly every major company broke all former sales records. True, apartment house sales contributed to the showing. But the overshadowing factor was prices which permitted large appropriations for sales promotional work, and provided an adequate margin for sales expense. In that way they attracted and held the best salesmen in the electrical industry.

A few months ago a price-cutting war flared up. Sales at once slumped. Advertising effort has been curtailed. The salesmen who were getting the bulk of the business, no longer able to make money on low-priced merchandise, are leaving for more promising sales work. Dealers are pushing refrigerators aside to sell radios and other equipment. The whole picture has changed. Lower prices changed it.

Commenting upon the predicament in which the refrigerator manufacturers are finding themselves, a washing machine manufacturer said to me: "We used to think the refrigerator people were smart, but they are fast becoming entangled in the same mire of low prices that has the washing machine industry by the heels."

You can count on one hand today the number of washing machine manufacturers who are making money. But it would take a thousand hands to count the dealers who lost money on washing machines and will have nothing more to do with them. They put a machine on the floor, but then and there, their interest ends. Is is any wonder the industry is in the doldrums?—J. C. Aspley in *The Printing Salesman*.

Letters from Readers

An Invitation to Florida Fair

Cranston-Thomas Research Bureau
Tampa, Fla.
Dec. 2, 1931.

Editor:

I would like to suggest that you make a visit to Florida and Tampa during the South Florida Fair and Gasparilla Carnival, for your column, "An Editor on Wheels," for I am sure that you will get an eye-opener and find a most interesting and exciting week's experiences.

The South Florida Fair is the fourth largest exposition in America. I will make it a point to see that you meet the outstanding people of the State of Florida, and are made a guest of the Fair with an entree to everything.

It has anything Atlantic City can offer skinned both ways for novelty and also for exhibits from every county in Florida.

The parades are beautiful and wonderful, and the sacking of the city by the pirates, after the landing of Gasparilla, the pirate who did really sack the city in its early history, is well worth traveling thousands of miles to see.

In refrigeration and food preservation, everything new will be introduced.

CRANSTON-THOMAS.

He Wants a Binder

Vernon Radio Corp.
545 E. 3rd St., Mt. Vernon, N. Y.
Nov. 30, 1931.

Editor:

Please let me know what a binder costs. The NEWS is growing and getting better and better.

HERBERT BARNES.

This 'Bible' Is Read

Florida Appliance Corp.
Daytona Beach, Fla.
Nov. 5, 1931.

Editor:

Just a line to let you know that we consider your publication indispensable, and we know of no other trade journal that covers its field more thoroughly. We consider it the "Bible."

ROY K. PELTON,
President.

Likes Proposition of Bound Volumes

Rex Mfg. Co., Inc.
Connersville, Ind.
Nov. 17, 1931.

Publisher:

We are in receipt of your favor of the 12th instant, also the bound volume of the October issue of REFRIGERATION NEWS which is a most excellent proposition and certainly will be interesting to those who have opportunity to see it. We will take delight in placing this on the table in our waiting room and shall report to you later how the plan works. I am sure it will work 100 per cent.

The news items themselves contained in the issues would accomplish the whole purpose but the manner in which it is bound and the attractiveness of it will command the attention of any who have opportunity to see it.

We thank you for sending us one of these books and asking our cooperation which we will be glad to extend.

C. C. HULL,
President.

Kind Words Dept.

I am most certainly renewing my subscription to the ELECTRIC REFRIGERATION NEWS, which news magazine I would not be without—P. J. Forsyth, branch manager, Wagner Electric Co., Cincinnati, Ohio.

Business is good for us in the San Joaquin Valley and we can't afford to miss a copy of the NEWS. The NEWS has been a big help to me and I appreciate your kindness very much—E. E. Martin, Martin's Refrigeration Service, Fresno, Calif.

Due to the fact that I am very much pleased with your paper I have interested a number of friends in same to the extent that they also desire to have your paper sent to them. Two outside myself have been receiving the NEWS since Jan. 1931—J. Winters, 2886 Briggs, Bronx, N. Y.

The engineering section is a very good addition to your regular paper—Robert G. Squier, 1134 W. 5th St., Plainfield, N. J.

On Our Bookshelves

ADVERTISING APPROPRIATION

Author: Albert E. Haase. Publisher: Harper & Bros., 49 East Thirty-third St., New York City. Price: $3.50. Publication Date: 1931.

Julius Klein, assistant secretary of commerce, tells us that the waste in distribution amounts to about $400 annually for each family in the United States, bringing the total far above the ten billion waste so often referred to.

An integral part of selling costs is advertising. And perhaps in no other cost is there so much confusion, so much guesswork, so little scientific knowledge as there is in advertising.

How much shall I spend in advertising and how can I determine that amount is a question which has long troubled business men, whether their appropriations amount to $1,000 or $10,000,000 a year. Then, after determining the amount, there is the ever-present query, "How shall I spend it?"

Now comes a book on the subject from the pen of Albert E. Haase, managing director, secretary and treasurer, Association of National Advertisers, Inc. Mr. Haase, who for years has handled many problems for many advertisers, has actual working knowledge of how much of the annual advertising expenditure in the United States is handled.

The new book falls naturally into two parts. The first part is devoted to an analysis of the various ways and means of determining the advertising appropriation and the second part to administering the appropriation after it has been determined.

The numerous existing methods of determining advertising appropriations are treated under four major classifications: (1) The Percentage Method; (2) The Unit-of-Sales Method; (3) The Mail Order Method of Buying Direct Sales or Inquiries, and (4) The Objective and Task Method.

These four methods are explained in detail with the comparative advantages and disadvantages of each. Each one is evaluated in accordance with a two-fold standard set-up by the author, (a) the method must relate the size of the appropriation to the marketing task to be accomplished, so that the sales opportunity may be maximized without waste, and (b) the method must relate the appropriation, under usual conditions and in the long run, to the volume of sales, so that profits and reserve may not be dissipated.

It is shown that while any one of the first three methods discussed may be used wisely under certain conditions which themselves supply checks and balances, only the fourth, the objective and task method, is preeminently satisfactory and meets both requirements.

The author believes that the objective and task method affords "as near an approach to a strictly scientific method" as we have available.

"Theoretically," he states, "it produces an inevitable figure, a figure that is just calculated to allow advertising to perform its functions effectively, but without waste."

In order to show how the objective and task method can be most effectively applied, the author describes the type of market analysis to be undertaken and explains in detail the operations required to establish trading areas, determine the buying power index for each area and arrive at sales quotas. He also shows how to determine, by means of a series of test campaigns, the amount and kind of advertising to use.

The final chapter of Part I, entitled "The Advertising Appropriation and Business Policy" deals in a practical way with advertising as related to general business conditions.

During periods of unusual fluctuations in business, such as the present business depression, a question of major importance to the buyer of advertising is whether he should increase advertising expenditures, cut advertising expenditures or stand pat. This chapter will provide valuable help in making such a decision.

In the second part of the book will be found answers to such practical questions as: "What are the functions of the advertising department?" "How can the advertising department cooperate most effectively with the sales department and the other departments of the business?" "What should agency service include?" "How should the agency be selected?"

"What points should be covered in the agency contract?" "What is the legal liability of the advertiser? The advertising agency? The advertising medium?" "What method of agency compensation is the most satisfactory?" "What expenditures should be charged to advertising?" and "What accounting records are needed to maintain budgetary control of the advertising appropriation?"

BROADCASTERS STUDY ADVERTISING ETHICS

WASHINGTON, D. C.—The Federal Radio Commission on Dec. 21 called upon every broadcasting station and company in the United States to give serious study to the problem of advertising by radio, suggesting that every holder of a broadcasting license study a code of ethics adopted by the National Association of Broadcasters.

The American system of broadcasting, which is based entirely upon the use of broadcasting stations for advertising purposes, has produced the best form of radio entertainment that can be found in the world, the commission believes, but it has laid itself open for criticism because of a certain type of advertising that has found its way to the air.

Radio Commission's Views

If the public can share in this entertainment only at the expense of advertising statements or claims which are false, deceptive, or exaggerated, or at the expense of programs which contain matter which would be commonly regarded as offensive to persons of recognized types of political, social and religious belief, then it is justified in demanding a change in the system, the Federal Radio Commission declares in its statement.

The solution to the problem, the commission's statement pointed out, rests with the broadcasters themselves, and they should be given a fair chance to make the necessary corrections. If they decline the opportunity, or fail to master the problem, the matter should be treated with proper legislation, it is declared.

Code of Ethics

The code of ethics adopted by the National Association of Broadcasters is as follows:

1. Recognizing that the radio audience includes persons of all ages and all types of political, social and religious belief, every broadcaster will endeavor to prevent the broadcasting of any matter which would commonly be regarded as offensive.
2. When the facilities of a broadcaster are used by others than the owner, the broadcaster shall ascertain the financial responsibility and character of such client, that no dishonest, fraudulent or dangerous person, firm or organization may gain access to the radio audience.
3. Matter which is barred from the mails as fraudulent, deceptive or obscene shall not be broadcast.
4. Every broadcaster shall exercise great caution in accepting any advertising matter regarding products or services which may be injurious to health.
5. No broadcaster shall permit the broadcasting of advertising statements or claims which he knows or believes to be false, deceptive or grossly exaggerated.
6. Every broadcaster shall strictly follow the provisions of the Radio Act of 1927 regarding the clear identification of sponsored or paid-for material.
7. Care shall be taken to prevent the broadcasting of statements derogatory to other stations, to individuals or to competing products or services, except where the law specifically provides that the station has no right of censorship.
8. Where charges of violation of any article of the code of ethics of the National Association of Broadcasters are filed in writing with the managing director, the board of directors shall investigate such charges and notify the station of its findings.

KELVINATOR UNITS SHOWN AT PRAGUE FAIR IN EUROPE

DETROIT—Kelvinator-Handels, A. G., distributor for Kelvinator in Switzerland, Austria, Czechoslovakia, and Hungary, displayed both domestic and commercial units at the Prague Fair this fall.

This fair is said to be the largest event of its kind in Czechoslovakia. A full line was displayed in the Kelvinator booth. The distributor has headquarters at Bahnhofstrasse 55, Zurich, Switzerland.

ICE-O-MATIC DEALER SELLS WARREN CASES

BALTIMORE, Md.—The Redding Co., Inc., 1724-1726 N. Charles St., distributor in this territory for the Williams Ice-O-Matic electric refrigerator, is now distributing Warren cases and boxes to be used with Williams Ice-O-Matic commercial electric refrigerating units.

Emmet M. Redding is president of the concern.

GRADE SCHOOL CHILDREN VISIT KELVINATOR

DETROIT—Thirty-eight eighth-grade pupils of Lincoln Park school, visited the Kelvinator factory, Dec. 9. After a tour of the plant, the party went to the Kelvin Kitchen, where the children were served frozen dessert and icebox cookies.

THE CHAMPION *baseball batter holds his hands like this. But that does not make him champion. Something unseen makes him superior to all others.*

What makes

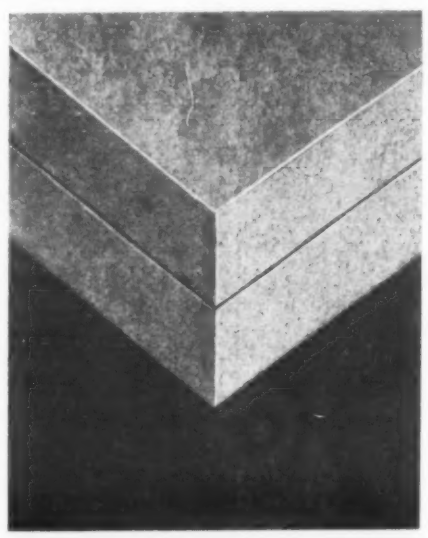
CHAMPIONS?

IT IS SOMETHING YOU CAN'T SEE!

THE things a consumer sees when buying a refrigerator are important. The finish must be attractive and easily cleaned. The food space must be adequate. The shelf arrangement must be convenient.

But even more important than all these is something that the consumer cannot see—the insulation inside the walls of a refrigerator. If that insulation is Armstrong's Temlok, the refrigerator will give better service for a longer period. Its efficiency will be the same after years of service. Refrigeration costs will stay low.

Temlok gives these advantages. It assures lower operating cost. That is why it pays manufacturers to use Temlok for their domestic refrigerators. They know its conductivity is low—its density is light—its moisture resistance permanent—its structural strength ample for every requirement. It is odorless and does not promote mold or bacterial growth.



CONVENIENTLY MADE in full half-inch, full inch, and laminated-inch thicknesses, and in built-up layers to desired thicknesses. Temlok is fabricated from the heartwood fibres of southern pine. These fibres are strong, sturdy, and moisture-resistant—manufactured into insulating board they are permanently efficient.

Manufacturers also know that Temlok is easily handled and installed. They know that it is made in fabricated sets, cut to size, ready for convenient, economical installation. And they have learned that this efficient insulation is available at low cost.

Write to us for samples of Armstrong's Temlok. We will also send you the illustrated Temlok broadside, explaining the outstanding details. Armstrong Cork & Insulation Co., 917 Concord St., Lancaster, Pa.

Armstrong's TEMLOK REFRIGERATOR INSULATION

ARMSTRONG CORK & INSULATION CO.
917 Concord St., Lancaster, Pa.

Please send me complete details regarding Armstrong's Temlok Refrigerator Insulation.

☐ Please send sample.

Name

Street

City State

'REFRIGERATOR ROW' EXISTS IN HARTFORD

HARTFORD, Conn.—With the Refrigeration Sales Co., Frigidaire dealer, settled in its new showrooms at 185 Ann St., Hartford now boasts a real "Refrigerator Row." Within half a city block of the intersection of Asylum and Ann Sts, seven makes are on display in as many showrooms.

The Refrigerator Sales Co., of which Robert K. Smith is president, and W. R. Gunberg, treasurer, had its formal opening during the week of Dec. 14. A few days previously Kelvinator-Rackcliffe Co., newly appointed Kelvinator distributor, opened at Asylum and Main Sts.

Other firms majoring in refrigeration who are in this concentrated "belt" are the Newton-Parsons Co., General Electric; True Utilities, Inc., Ice-O-Matic; Frederick Raff Co., Mayflower; Connecticut Electric Refrigerating Co., Westinghouse, and Hub Radio Store, Majestic.

The district is midway between the railroad station-Hotel Bond area and the central business section.

The large display facilities of the Hartford Electric Light Co., handling all makes, are but a block away, and there are numerous small radio and music shops in the neighborhood which handle various makes of refrigerators.

REFRIGERATION WHOLESALER CHARTERED IN INDIANA

INDIANAPOLIS, Ind.—Articles of incorporation have been filed with the secretary of state, here, by McConnell-Morris, Inc., having headquarters at Princeton, Ind.

The corporation will wholesale electric refrigerators, radios and accessories. The first board of directors is composed of Roy E. McConnell, Uriah C. Morris, Ella May McConnell and Loreen Morris.

Championship Norge Five

For three years Reinhard Bothers Co., Inc., of Minneapolis, Norge distributor, sponsors a championship basketball team. First row (left to right): Kenny Oliver, Bing Law, Glen (Tubby) Welton. Standing: A. L. Milner, Stan Hauge, Freddie Tyvol, John Sylvester, Conrad Hoff coach.

ROEDER WILL MANAGE NEW REFRIGERATION DIVISION

INDIANAPOLIS, Ind.—Walter Roeder will be the new manager of the recently created electric refrigeration and household electric appliance department at the Em-Roe Sporting Co., of this city, it was announced, Dec 19.

Sampson electrical appliances and Majestic refrigerators will be marketed by the company.

Wins Bet; Freezes Hand; Sues

BEACON FALLS, Conn.—Satirmir Klimasieski won his bet when Chester Zambroski said he couldn't hold a piece of dry ice in his hand for two full minutes, but now he has brought suit for $5,000 in a civil action started in Superior Court.

The wager, Satirmir says, was for drinks for the crowd in Zambroski's store in Union City, but the storekeeper failed to tell him that ill-effects might follow. He has lost some of the use of his left hand, which is now subject to attacks of chilblains.

Best Wishes for 1932

We offer our sincere good wishes for your happiness and prosperity during the coming year. Back of our good wishes are plans to constantly increase the salability of our products through a determination to raise the standards of electric refrigeration value—a determination that is reflected in the new domestic line which we will introduce in the near future.

Universal Cooler Corp.

Detroit, Mich. - - Windsor, Ontario

KELVINATOR UNITS BOUGHT BY UNIVERSITY OF IDAHO

MOSCOW, Idaho—Two dormitories, the infirmary, a fraternity, and a sorority house at the University of Idaho have been equipped with Kelvinator refrigerators within the last 30 days, according to Davids', Inc., dealer here. Glen Philippi is manager of the refrigerator department.

Lindley Hall, the boys' dormitory, was equipped with a P-68 Seeger cabinet, an F-11 Kelvinator condensing unit, a No. XP-100 dry system Kelvinator coil, and a thermostatic expansion valve.

In Ridenbaugh Hall there were installed a P-44 Seeger cabinet, an S-18 Kelvinator condensing unit, a No. XO-90 dry system Kelvinator coil, and a thermostatic expansion valve.

In the Delta Delta Delta sorority house a DeLuxe 14 model was installed. The same model was installed in the university infirmary.

The Sigma Nu fraternity house was equipped with a P-21 Seeger cabinet, a No. S-16 condensing unit, a No. XO-60 dry system Kelvinator coil, and a thermostatic expansion valve.

SOMERSET SUPPLY STORE SOLD TO CANNON ELECTRIC

PRINCESS ANNE, Md.—Cannon Electric, Inc., has succeeded to the electric refrigeration, radio, and electrical appliance business formerly operated under the name of the Somerset Electric Supply Co., here.

H. Everett Cannon, former general manager of the Somerset Electric Supply Co., is president of Cannon Electric., Inc.

The concern, which sells Westinghouse refrigerators, has moved into its new quarters in the Kerscher Bldg.

Mr. Cannon plans to open a branch at Crisfield, Md.

KELVINATOR BILLBOARDS USED IN AFRICA

DETROIT—Billboard advertising campaigns are now being carried on by two Kelvinator distributors in Africa, according to the Kelvinator export department. The two firms are the Agence Generale Pour Le Moroc (Morocco), and Barker & Smith, Pietermaritzburg, Nataz, South Africa.

$75 ALLOWANCE GIVEN AS INTRODUCTORY OFFER

SPRINGFIELD, Ill.—For two weeks during the holiday season the Bruce Co., 206 E. Monroe St., here, allowed new purchasers of an Apex electric refrigerator $75 for their old ice boxes. This is a special, introductory offer.

Kelvinator Distributor Uses 3 Sources In Securing Sales Leads

WASHINGTON, D. C.—Three methods of securing sales leads are used by Barber & Ross, Inc., Kelvinator distributor in the nation's capital and adjoining counties in Maryland.

The city of Washington is divided into 12 zones and worked by door-to-door canvassers who unearth prospects, according to Julian A. Green, retail sales manager.

The second method is by following up purchasers, and by securing the names of their friends who might be interested in purchasing an electric refrigerator. The third method is through a Booster Club for users.

Members of the Booster Club are given a pack of 10 post cards which they send to their friends. These leads are followed up by field salesmen.

Five Sales Departments

Barber & Ross, hardware merchants in Washington, D. C., are wholesale and retail distributors for the city of Washington and adjacent counties in Maryland for the Kelvinator. Sales are divided into five separate departments, viz: (1) Builders and wholesale; (2) Apartment house buyers; (3) Commercial; (4) Water coolers; (5) Domestic or retail sales to homes.

"In the retail sales field there is always an experienced man on the floor of the store who has a record for closing and who works on a salary basis, while outside canvassing salesmen are not given any floor days, but must work out in their territory at all times," Mr. Green said in explaining the sales plan.

"Nor are they allowed to sit in the store and wait for a customer to come in because the management believes that much valuable time is lost for the salesman. The only exception is where the customer and the salesman come in together.

Sales Floor Prohibition

"But none of the outside field force are allowed on the floor unless accompanied by the prospect and if they have the prospect registered. However, even if the salesman does not come in with the customer he is not penalized, but gets his full commission on any prospect that he nas who purchases a Kelvinator on the floor of the store. The supervisor is also protected 100 per cent.

"The men might like to come around the store and loaf too much," explained Mr. Green, "So I do not permit them to come in at all. If you permitted them to have floor days you could not show any partiality.

"You would have to let new men take the floor as well as the old ones and lots of sales are muffed on tne floor through poor salesmanship. I do not believe in using my floor as a proving ground for salesmen. When prospects come into the store, they are about three-fourths sold anyhow. But we believe in giving the salesman his due and if he has acted as a bird dog let him get the full commission.

20 Men in Field

"We want our outside salesmen to be out in the field steadily plugging. They should ring doorbells and spend five minutes or take an hour to each prospect, according to the leads they get. We have two men on the floor and sometimes as high as 20 out canvassing. One of the greatest problems is your manpower and the turnover in the sales force. With a straight commission proposition, it is harder to hold men.

"We have three supervisors," explained Mr. Green. "We will not make a man a supervisor unless he has some executive ability and also some ability to get the work out of the men. We believe that every supervisor should be paid a salary and that he should give his undivided attention to his men, and not be out selling, himself.

Sale On Third Contact

"When you have a supervisor on a straight commission basis, you have only a one-man organization in the territory he covers. He is not going to give the necessary time to his men. He is too busy getting all he can himself, but by paying him a salary you have more manpower than that represented by the men.

"We figure that a salesman ought to make a sale on the third contact and unless a salesman can give a good reason for not closing the deal, he forfeits all rights to such prospect who in turn is turned over to another more capable salesman or the case is disposed of as the sales manager sees fit. All prospects over 30 days old are declared to be "dead" and their names are removed from the files.

Problem of Closing

"Closing is one of our most trying problems. We try to solve that problem by having open voice meetings, at which we have each salesman relate his experience, for the previous day so as to let the other men benefit therefrom. If you have 20 men it is the same as having 20 days' experience at one meeting.

"We require the men to attend these meetings, which are held every morning for the purpose of receiving instructions and exchanging experiences. We find this has been very beneficial to all of us and has resulted in greater volume of sales. A special class room is used for this purpose and salesmen are not allowed to congregate on the floor.

"I have always issued a sales manual. We have had so much misunderstanding, saying they didn't know this or they didn't know that, so I sat down and put the whys and wherefores in writing—in black and white and gave each man a copy. This manual outlines the organization plan, appearance of the salesman, conduct, writing up orders and contracts, commissions, trade-ins, reverts, protection of prospects, sales meetings, selling equipment."

Selection Through Interview

Salesmen are selected through interview and after they are hired, they are put through a three days' training in the store. In the meantime, a report is obtained on them from a local agency as to their credit standing and living habits. They follow a prescribed course of training in the principles of electrical refrigeration, but get no confidential information as to prices and discounts.

"Of course," continued Mr. Green, "you can not put words into the mouths of your salesmen. We get them enthusiastic for what they are selling and to have enthusiasm in their hearts and minds, otherwise they will never make success as salesmen. If you are sold on a product you can sell it.

Enthusiastic Instruction

"Some instructors do not get salesmen enthusiastic enough and do not break down the fear which the man entertains. That is why many salesmen fail. They are afraid they can not do it, that they might starve to death or "sumpthing." If you have fear you can not have enthusiasm.

"I also try to kep the men on a friendly basis, with a cooperative feeling toward one another instead of an antagonistic feeling—keeping the organization straightened out—not to talk around, but bring it to light. I will not let one salesman carry a chip on his shoulder about another one. I bring them in and let them fight it out.

Must Play His Part

"After all is said and done an organization is nothing more or less than machinery finely geared, and each man represents a certain wheel in it, and if he doesn't play his part there are going to be rough spots. The gears won't mesh and there will be discord which will tear down and break down an organization quicker than anything else in the world.

"One of the biggest troubles in selling today is that a commission salesman is not as fair with himself as he would be if he were an employe drawing a straight salary. He would then be afraid not to work, but on a commission basis they are not fair to themselves and won't work. But we want a man who who can be fair with himself.

"Business has really settled down now to selling. You do not have such a thing any more as sales resistance, because electrical refrigeration is now known to everybody. However, the time is coming, I think, when we will have to change from a straight commission basis to a salary basis."

RHODE-COPELAND OPENS AS JERSEY CITY DEALER

JERSEY CITY, N. J.—The Rhode-Copeland Co., 3527 Boulevard, has been opened as a Copeland dealer by the Binder Distributing Co., of Newark, according to Benjamin Binder, president of the company.

Officials of the new store are Jacob Rhode, Francis Klem, and William Mussman, all of whom have had experience in the automotive field. The firm employs three salesmen.

SIX WESTINGHOUSE WATER COOLERS PUT IN SCHOOL

BALTIMORE, Md.—Parks & Hull, Inc., Baltimore distributor for Westinghouse products, has installed six Westinghouse electrically refrigerated water coolers in the new Baltimore City School Board of Education Administration Building, erected at Twenty-fifth and St. Paul Streets.

S. Gordon Parks is president of Parks & Hull, Inc., and George Hull is a partner in the business. William Carle is manager of the refrigeration division.

BALTIMORE FRIGIDAIRE NAMES SALES HEAD

BALTIMORE, Md.—Walter T. Startzman has been appointed sales director or director of sales of the Frigidaire Sales Corp. retail store, Howard and Mulberry Sts.

For the past year he has been associated with the retail store of the Baltimore branch of Frigidaire Sales Corp.

REFRIGERATION VALUE SHOWN IN FUR STORE

LOS ANGELES—Acknowledgment of the importance of electrically refrigerated fur storage is set forth in a survey recently conducted by the May department store, here.

"We can store 10,000 garments in our fur department and main cold storage vault," states Fred Harling, manager of the fur department. "In addition we have thousands of rugs, curtains, a collection of wild animal heads, trophies—all of which bring revenue.

"This diversified storage means a constant influx of folks who would not otherwise come into the store, it means big sales volume and added revenues for all departments."

Temperatures for fur storage vary according to the experience of fur managers. Some advocate a fluctuating temperature, at 20° F. one day and 40° the next. Others have found, through tests that temperatures of 40 to 45° F. are sufficient to protect goods from moths, or insects. The larvae is dormant below 45° F. and moth eggs do not hatch below 60° F.

The advocated relative humidity in a fur storage vault is generally about 55 per cent.

All fur garments must be cleaned before storage to prevent rot. After the cleaning and fumigating processes have been completed, the garments are given numerical tickets and hung on racks with corresponding numbers.

Inventory is taken once each year, Mr. Harling states.

Furs, coats, garments are stored on hangers, rugs are rolled, curtains are hung, animal heads are placed on wall hooks. There are shelves for other merchandise, many other lines of dry goods merchandise often being stored in this manner to save them from spoilage and deterioration.

KELVINATOR ECONOMISTS ATTEND FACTORY SCHOOL

DETROIT—A two-day refrigeration school for new factory home economists going into the field was directed Dec. 9 and 10 by Miss Marion Sawyer, Kelvinator home economist.

The school was also attended by Miss Helen Campbell, of *Chattelain*, Canadian woman's magazine, Miss Bernice Rounich, home economics director of the Electrochef Co., and Mrs. M. E. McRae, home economist of the Toronto branch, Kelvinator of Canada.

Topics covered in the sessions of the school were, theory of refrigeration, mechanical operation, need of refrigeration, cabinet construction, use and care of the refrigerator, and refrigerator recipes.

Miss Sawyer spent a week at Portland, Me., with the Cumberland Power & Light Co., where she had two large schools, held meetings for sales and service men, and worked with home service women. She also spent two days at the Cook County Refrigeration Bureau show at Blue Island, Ill.

FOUR NEW DISTRIBUTORS OF LEONARD APPOINTED

DETROIT—Four new distributors for Leonard electric refrigerators have been signed recently, reports R. I. Petrie, sales manager of the Leonard Refrigerator Co. They are the Midwest Timmerman Co., Dubuque, Iowa, the Hendrie-Boltdoff Mfg. Co., of Denver, the North Coast Electric Co., Seattle, and the Chanslor-Lion Stores, Inc., of San Francisco.

Mr. Petrie, who left Detroit Nov. 21 on a trip to the Coast, signed the Dubuque distributor in cooperation with district manager R. W. McCaskey. At a sales meeting in Des Moines with distributors Paxton, Gallagher & Co., Mr. McCaskey and Mr. Petrie explained the 1932 Leonard line.

Mr. Petrie will visit Los Angeles, El Paso, Tex., and Kansas City, on his return to Detroit this week.

GENERAL ELECTRIC DEALER HOLDS OPEN HOUSE

GREENSBURG, Ind.—The Greensburg Electric Shop, newly announced General Electric dealer here, held open house and a home appliance exhibit recently, including an exhibit of General Electric refrigerators.

Robert Gray, head of the firm, supervised a contest in which total prize money amounted to $300. Ernest J. Cory heads the repair and service department.

DAIRY COMPANY APPOINTED FRIGIDAIRE DEALER

FORT DODGE, Iowa—The Elgin Dairy Co., 315 Second Ave. S., has been named to handle Frigidaire electric refrigerators here.

Lewis Richards of the dairy company has made arrangements for display space in the Laufersweiler Furniture Co. store.

Spinney and His Business Spinners

B. H. Spinney, Norge distributor, recently became distributor in Albany, N. Y., as well as Springfield, Mass. Mr. Spinney is seated, and standing (left to right), are: H. G. Underwood, Poughkeepsie, N. Y.; F. H. Dow, Pittsfield, Mass.; O. W. Jenkins; H. L. King, service manager; and J. J. Davin, Norge factory divisional manager.

WIRED HOMES SHOW INCREASE IN 5 YEARS

WASHINGTON, D. C.—The first nine states from which figures have been compiled on the national survey of homes wired for electricity indicate that the number of homes in the United States receiving electric service has appreciably increased during the past five years.

This prediction comes from the electrical equipment division of the Department of Commerce, which, in cooperation with the National Electric Light Association, is conducting the study. Marshall T. Jones is chief of the electrical equipment division.

The nine states for which the count of wired homes is now complete are: Michigan, 932,982; Indiana, 589,701; Missouri, 551,903; Wisconsin, 521,275; Kentucky, 241,541; Tennessee, 204,683; Louisiana, 166,802; Utah, 94,462; and Arizona, 54,269.

Data for the remaining states is expected to be complete and ready for distribution by the end of 1931. This information, together with a count of commercial meters, will be printed later in bulletin form.

SERVEL DEALERS

HAVE FOUND

SIMPLIFIED REFRIGERATION SELLS!

THE Servel Hermetic, during the past year, uncovered a tremendous market for Simplified Refrigeration in spite of general business conditions.

Thousands of families chose the silent, carefree refrigeration of the Servel Hermetic. These people refused to wait till times were better. They ordered *promptly* . . . for immediate installation.

NOW A NEW SEASON!

A new selling season is now approaching . . . with every indication that refrigeration will continue to outdistance other industries.

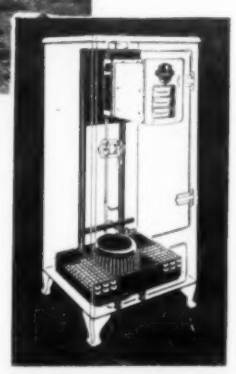
Servel dealers find themselves firmly entrenched . . . with almost unlimited profit possibilities straight ahead.

They have a list of selling points that would be hard to beat . . . a simplified electric refrigerator at prices every family can comfortably afford.

SERVEL SALES, INC., EVANSVILLE, INDIANA

QUICK FACTS

Hermetically sealed unit . . . No kitchen repairs . . . No intricate adjustments . . . No replacement of parts . . . Fewer moving parts . . . No moving parts exposed . . . Quietest electric refrigerator . . . Handy temperature control . . . More usable shelf space . . . Beautiful, graceful cabinets . . . Flat, usable top . . . No installation problems.



SERVEL

HERMETIC

Write for complete details of the attractive Dealer Plan that insures a generous share of sales for you.

Little Stories of Interesting PEOPLE In the Refrigeration Industry

THE EXPANSION VALVE

Little Stories of Interesting IDEAS In the Refrigeration Industry

By George F. Taubeneck

Speed! Action!

Action every moment! New high sales records, contests galore, prizes, new ideas, big conventions of happy quota-busters, increases in factory space, financial statements indicating increased profits, new companies in the field, co-operative movements gaining momentum, clever publicity stunts, new developments in home cooling, refrigerated trucks, and quick-frozen foods, changes in personnel, expansion, promotions, new sales ideas—what a year was 1931!

Were the above paragraph directed to the country-at-large instead of the refrigeration industry, those who read it would shake their heads sadly and sigh: "Too bad he had his dates mixed. If only it all were true!"

But refrigeration men can nod heads proudly in assent and say: "That's right! He's talking about ME."

It *was* a scintillating year. To be sure, it was a struggle all the way. But struggles make news, and the fast-moving electric refrigeration industry made so much news during 1931 that ELECTRIC REFRIGERATION NEWS had to become a weekly Sept. 9 to keep up with the pace the industry was setting.

New Sales Records

Leafing through back issues of ELECTRIC REFRIGERATION NEWS for 1931, we run across items like the following:

April 8—Two record orders of 2,000 and 1,000 household refrigerators received by Norge Corp. from Pennsylvania distributors cause Norge Corp to step up production schedule to 1,800 units per week. Trilling-Montague gave first order, and Ludwig Hommel & Co. the other. Norge Corp. has gone national in sales operations for first time.

May 6—Kelvinator reports biggest April in its history, with 23,087 units produced, and a 10 per cent increase in shipments. Servel reports shipments 158 per cent over the 1930 mark for the same period. Copeland orders increased 48.19 per cent over April, 1930.

G. E. sales broke all-time mark, when 1,400 carloads of monitor tops were shipped. Leonard business was 70 per cent ahead of its quota for the month. Dry-Zero sales for April were the greatest in history, and exceeded the March figure by 25 per cent.

May 20—Shipments for Norge for the first 15 days in May were 34.6 per cent greater than the corresponding period last month and 216.5 per cent greater than May, 1930. Increases since January show an increase of 528 per cent, according to Mr. Knapp. An order for 2,500 units came from Trilling-Montague Co., Philadelphia.

More Mayflower orders were booked during the first four and a half months of 1931 than were received during all of 1930, according to L. G. Lindsay, vice president of Trupar. A sales increase of 347 per cent over April, 1930, was recorded last month.

Frigidaire orders booked for April were nearly double those of the three preceding months combined, and the factories are running on a 60-hour a week basis to keep pace with field requirements, E. G. Biechler, president and manager, says.

The June manufacturing schedule for household models has been increased 33 per cent. Retail sales for the month were 77 per cent higher than in March, and total shipments for the month were 23 per cent higher than that of the same month last year.

Majestic refrigerator production was increased May 19 to 1,000 daily, according to Don Compton, vice president and general manager. Majestic has been manufacturing 750 daily for some time. June 1 they expect to begin turning out 1,500 daily.

June 17—May was the most successful month in the history of Williams Ice-O-Matic sales, with sales showing an increase of 500 per cent over May, 1930. Night shifts are being operated in many of the departments to meet production demands.

May sales of the Norge Corp., equaling 98.1 per cent of the company's entire output in 1930, was the best month in the history of the organization, says John Knapp. A summary of the first five months of this year shows a net gain of 547 per cent over the same period last year.

Dry-Zero records for shipments in a single month were broken in May, when 112 carloads were shipped from the company's plant in Chicago. The company's business for the first five months of 1931 surpasses that of the whole of 1930. The two largest users of Dry-Zero pliable slab this month were Borg-Warner (Norge) and Grigsby-Grunow.

July 1—Net sales of the Grigsby-Grunow Co. for the month of May amounted to $2,609,086.24 as compared with sales of $558,778.68 for May, 1930, due to new business on Majestic electric refrigerators, according to Don N. Campbell. The company closed for a 10-day factory holiday June 26 and will resume operations July 6.

July 15—Sales of household Frigidaires during June show a gain of 27 per cent as compared with June a year ago, according to E. G. Biechler, president and general manager. Gains range as high as 79.5 per cent, recorded in Davenport, Ia. Two weeks ago, July production was increased 32 per cent above that of the corresponding month last year to meet sales requirements. This week the schedule was increased again.

Kelvinator Corp. has shipped 89,853 units up to June 22 of the present fiscal year as compared with 79,978 in the corresponding period last year. During June, the company shipped more than 11,000 units against 8,660 units in June, 1930.

Aug. 12—Shipments of the Kelvinator Corp. for the month of July ran 49 per cent higher than those for the same period in 1930. Kelvinator's net profit for the quarter was $1,714,407 before the deduction of federal taxes, and it retired all its outstanding 6 per cent convertible gold notes at a call price of 105.

And from the new weekly ELECTRIC REFRIGERATION NEWS we cull these newsleads:

"MANSFIELD, Ohio, Sept 8.—Sale of Westinghouse electric refrigerators during the first eight months of 1931 is 400 per cent ahead of the sales for the same period of 1930 according to an announcement by C. E. Allen, commercial vice president of Westinghouse Electric & Mfg. Co." (Sept. 9, 1931.)

"MT. CLEMENS, Mich.—Consolidated sales of Copeland Products, Inc, and subsidiaries for Aug., 1931, showed an increase of 43.7 per cent over sales for Aug., 1930, Louis Ruthenburg, president of the company, announced Sept. 24.

"The net increase in sales for the fiscal year to date is 21 per cent over the corresponding period of 1930." (Sept. 30, 1931.)

"MT. CLEMENS, Mich.—Shipments of Copeland commercial refrigerating units increased 59.4 per cent during the fiscal year ending Oct. 31, 1931, over those of the same period in 1930, W. D. McElhinny, vice president of Copeland Products, Inc., announces." (Nov. 11, 1931.)

"BLOOMINGTON, Ill.—An increase of 156 per cent in the sale of Ice-O-Matic refrigeration units during the year ending Oct. 31 over the corresponding period of 1930 is reported by C. U. Williams, president of Williams Oil-O-Matic Heating Corp." (Dec. 23, 1931.)

New Plants, More Space

Bigger sales volumes and increased production naturally call for more plants, bigger factories, more manufacturing space. From early 1931 issues of the NEWS we pick up these typical items:

April 8—Trupar adds new wing to its Mayflower factory, and steps up production to a 24-hour a day schedule. Installs new machinery, takes membership in refrigeration division of N. E. M. A.

July 1—G. E. will consolidate the manufacturing of the regular line of refrigerator cabinets in Erie, Pa., within a short time, it was announced by A. M. Sweeney, production manager for G. E. at Cleveland.

The new $300,000 cabinet warehouse in Erie to be used for this purpose is near completion. It has a floor space of 140,000 sq. ft. and a storage space of 70,000 refrigerator cabinets. At present cabinets are being manufactured in both Schenectady and Erie.

The weekly ELECTRIC REFRIGERATION NEWS reports these items:

"EVANSVILLE, Ind.—Final construction details on the new building addition to the Sunbeam Electric Mfg. Co., manufacturer of Sunbeam electric refrigerators, electric generators, farm lighting systems, and locomotive headlights, will be completed this week, the M. J. Hoffman Construction Co., builder, stated.

"The modern building, costing with equipment about $45,000 is a fireproof structure of brick, steel, and concrete. It will have two stories, providing about 25,000 sq. ft. additional area for production of Sunbeam refrigerator plants." (Sept. 9, 1931.)

"CLEVELAND—Building of Apex electric refrigerators will be transferred from Fort Wayne, Ind., to Painesville, Ohio, according to C. G. Franz, president of Apex Electric Mfg. Co.

"Apex has leased the factory building of the Bakelite Corp. at Painesville and will move . . ." (Sept. 30, 1931.)

"DAYTON—Plans for the addition of 30,000 sq. ft. of factory space to take care of the 1932 production schedule—which is set at double that of 1931—were announced by H. J. Hunt, president of the Trupar Mfg. Co., at a conference of Mayflower refrigeration jobbers here Thursday and Friday, Oct. 16 and 17." (Oct. 21, 1931.)

"FRENCH LICK, Ind.—For the first time in the history of the Norge organization, distributors of Norge electric refrigerators were assembled to confer on plans for the coming year, here, Oct. 12, 13, and 14. . . The Alaska Refrigerator Co. of Muskegon, Mich., which has been making cabinets for Norge refrigerators, has been acquired by the Norge Corp., and will be operated under the direction of Norge production engineers exclusively for the manufacture of Norge cabinets." (Oct. 21, 1931.)

"EAST PITTSBURGH, Pa.—Beginning Jan. 1, 1932, refrigerator cabinets will be manufactured in the Mansfield, Ohio, works of the Westinghouse Electric & Mfg. Co., it was announced last week.

"'Westinghouse refrigerator production will be doubled next year,' C. D. Taylor, refrigeration sales manager, stated." (Nov. 4, 1931).

"EVANSVILLE, Ind.—The Sunbeam Electric Mfg. Co., manufacturer of electric refrigerators, will enter 1932 with larger operating force.

"'The schedule for the next year calls for 50 per cent production volume increase,' William A. Carson, president and general manager, stated.

"The increased production schedule proposed is made possible by a recently completed addition, costing about $50,000." (Nov. 11, 1931.)

"MUSKEGON, Mich.—More than $350,000 will be spent in improving the plant of the former Alaska Refrigerator Co., which was purchased by Norge Corp." (Nov. 11, 1931.)

"DETROIT—Manufacturing capacity of the Universal Cooler Corp. was doubled last week with the removal of its two plants, one at Eighteenth and Howard Sts., the other at 1560 Theodore St., to the factory building at Green and Melville Sts., here. The new plant was formerly occupied by Nizer Corp. and the Electric Refrigeration Corp." (Dec. 2, 1931.)

More Coming

Lack of space in this issue makes it necessary to continue this unorthodox history of the electric refrigeration industry for the year 1931 until the next (January 6) issue of Electric Refrigeration News.

The Expansion Valve in that issue will tell something about 1931 developments in connection with the three-year guarantee, public utility merchandising legislation, coin-meter selling, the Electric Refrigeration Bureau, refrigerated trucks, air conditioning, quick-frozen foods, companion products, patent and trademarks decisions, fading and defunct concerns, appointments and promotions, and other events in the year's news.

Indications are that 1932 will be fully as interesting and exciting and pregnant with news as was 1931. Whatever may happen, and wherever it may be going on, Electric Refrigeration News will be on the job to report it for you in detail.

Profits in 1931

That profits were not sacrificed in the mad scramble for volume was indicated in a number of financial statements issued during the fall months. The weekly ELECTRIC REFRIGERATION NEWS reports, for instance, the following:

"EVANSVILLE, Ind.—Earnings of $548,524 prior to the deduction of federal income tax reserve and interest on funded debt were reported for the quarter ending July 31 by Servel, Inc., manufacturer of Electrolux and Servel hermetic refrigerators and Hercules gas engines and truck bodies.

"Net earnings for the quarter amount to $483,220, according to Herbert H. Springford, chairman of the board of Servel, Inc." (Sept. 9, 1931.)

"DETROIT—Kelvinator Corp. retired all of its remaining outstanding 6 per cent Gold Notes, due in 1936, at the call price of 105 on Sept. 30.

"George W. Mason, president, points out that during the fiscal year which ended Sept. 30, 1931, the company had retired Gold Notes to the par value of $925,500, leaving $1,603,500 outstanding as of that date." (Oct. 7, 1931.)

"DETROIT—Net earnings of $1,761,709.19 or $1.53 a share on the 1,147,302 outstanding shares of the company's stock were shown by the Kelvinator Corp. for the fiscal year which ended Sept. 30, 1931, according to the annual statement delivered by George W. Mason, president and chairman of the board of the Kelvinator Corp., at a meeting of the board of directors, Nov. 17." (Nov. 25, 1931).

"DETROIT—Earnings of $1 per share on Class "A" stock, and $0.17 per share on Class "B" stock were reported by G. M. Johnston, president of the Universal Cooler Corp., in the annual stockholders' meeting, Nov. 25." (Dec. 2, 1931.)

"BLOOMINGTON, Ill.—A net profit for the fiscal year ending Oct. 31, of $15,651.47 as opposed to a loss for the previous fiscal year of $321,178.55 is reported by the Williams Oil-O-Matic Heating Corp." (Dec. 9, 1931.)

MT. CLEMENS, Mich.—Consolidated net profits of Copeland Products, Inc., for the fiscal year ended Oct. 31, 1931, are $314,441.48, after provision for depreciation, reserves and Federal taxes. Louis Ruthenburg, president, announces. (Dec. 30, 1931).

The Golden Era of Sales Contests

Recognizing the fact that the dealer and the salesman are the keys to greater volume, the industry in 1931 placed considerable emphasis upon sales contests. Almost everybody joined the game, and beginning with midsummer—when executives were trying to figure out how to extend the selling season into autumn and winter—one contest after another was run by the leading concerns.

Larger commissions, merchandise prizes, trips to the factory, and (most important of all) the "fight" element, the love of battle, the chance for recognition among their fellows—all these helped inspire salesmen and dealers to greater efforts.

As a result the sales of electric refrigerators held up during the cooler months for the first time in the history of the industry, and "outside" dealers were so impressed by the results contesting dealers were getting that they took heart and did not slash prices, hence avoiding the wholesale dumping which had been feared might happen.

From summer issues of ELECTRIC REFRIGERATION NEWS one gleans the following facts which picture the start of the contest movement:

July 1—Norge district managers and Cramer-Krasselt representatives were called to a one-day meeting June 18 by John H. Knapp, vice president in charge of sales, to learn details of the "Norge Rollator Marathon Contest" which will start July 15. This will be Norge's first national contest.

It is estimated that 45 distributors and eight branches, together with about 4,000 dealers, will enter the contest. Each participant completes only with himself.

July 15—Kelvinator opened a nine-week contest and sales drive involving an expenditure of $250,000 this morning. Featured in the sales campaign will be two groups of prizes, the first, totaling $20,000 to be awarded prospects who submit the best letters on "What I Have Learned About Kelvinator," while the second purse of $18,000 will be divided among dealers and salesmen in the territory of winning distributors.

The race will be conducted similar to a horse race, and is called the Kelvinator Derby. Seventy million newspaper advertisements, costing $185,000, will be used during the campaign.

July 29—Servel dealers throughout the U. S. are now in the midst of a race with "Old Man Quota" for a trip to the Servel factories in Evansville in September.

A sales contest starting July 20 and ending Sept. 30 for cash prizes is being carried on by Copeland salesmen. Prizes for the five highest are bags of gold, ranging from $300 down to $50, plus merchandise of all descriptions. The units in the contest are designated as "ice cubes." Orders must be installed by Nov. 1.

Westinghouse opens a two-month "Build-a-Refrigerator" sales contest for retail salesmen July 29. Winners will win merchandise prizes; sale of any unit marks a definite addition to the phantom refrigerator which the salesman is building.

Two sales promotion contests are being conducted by Apex—the One Hundred Per Cent club's first anniversary jubilee for dealers and salesmen, and the district manager's heavyweight contest. The first of these, beginning in July, continues to Sept. 1, the heavyweight contest extending from June 15 to Aug. 31, has as its aim the securing of 500 new Apex dealers. Cash bonuses will be given as prizes.

Cleveland branch won the June Kelvinator factory branch contest, ending June 30, it has been announced. This branch showed a gain of nearly 100 per cent over June, 1930. The New York branch was second. The winning branch will be entertained at a $500 "party" to be sponsored by officials of the Kelvinator Corp.

George Patterson, Inc., Florida General Electric distributor, finished first in the General Electric transcontinental blimp race, a refrigeration sales contest, with a sales record of 152 per cent of quota. The National Electrical Supply Co., of Washington, D. C., had a score of 133 per cent of quota for second place.

Aug. 26—G. E. distributors meeting at Association Island planned their campaigns to run for "President of Refrigerania" in a sales contest lasting from Sept. 14 to Nov. 21. Sixty-two distributors are candidates for president, the winner to receive a Chrysler convertible; the next six will be "cabinet members," and will get Ford pick-up trucks for refrigerator delivery.

Progress of the contests during the Fall, when they tumbled over one another fast and furiously, was recorded week-by-week by ELECTRIC REFRIGERATION NEWS. Significant "leads" from some of these stories are reproduced below:

"DETROIT—Distributors and salesmen of Temprite water coolers, manufactured by the Liquid Cooler Corp., have started competing in a sales contest which began Sept. 15, and will be brought to a close Dec. 1." (Sept. 23, 1931).

"MANSFIELD, Ohio, Sept. 28—Westinghouse Electric & Mfg. Co. will announce, at a distributors' meeting, here, Oct. 1, at the completion of their nation-wide "Build-A-Refrigerator" contest, a new national competition.

"The new contest, which will start Oct. 12 and close Dec. 12, will be known as the Westinghouse refrigerator "Onto-Mansfield" expedition and . . ." (Sept. 30, 1931).

"DETROIT—Home stretch drives upset some of the favorites in the Kelvinator sales derby on 10 famous race tracks, final complications by promoters of the derby show." (Oct. 14, 1931).

"MANSFIELD, Ohio, Oct. 12—J. W. Ryan, apartment house salesman for Allen-Ingraham, Inc., New York metropolitan dealer of Times-Appliance Co., built 12 refrigerators to win first place in the Westinghouse "Build-a-Refrigerator" contest, taking the championship away from R. N. Snyder, Hempstead, L. I., N. Y., in the last week of the contest." (Oct. 14, 1931).

"MT. CLEMENS, Mich.—D. J. Coughenour, president of the Radio Electric Store of Springfield, Ohio, will soon be riding in a brand new Chevrolet coupe as a result of winning first place for distributors in the national Copeland sales contest which opened the latter part of July and ran through August and September." (Oct. 14, 1931).

"DETROIT—Announcement of a $50,000 contest for salesmen and a Christmas selling plan has been made by Kelvinator Sales Corp., through the release of a booklet this week presenting the details of the campaign.

"Known as the "Silver Seal Campaign," the Christmas plan went into effect Oct. 19. The sales contest will continue until Dec. 24."

"ROCKFORD, Ill.—Distributors and salesmen of the General Refrigeration Co. are competing in the Lipman Jockey Club handicap which started Oct. 26 and will close Dec. 31.

"Company officials expect that more than $5,000 in cash prizes will be disbursed during the race. . . ." (Nov. 4, 1931).

"DETROIT—Mrs. Edward P. Holmes, Oakland, Calif., will receive a check for $5,000 as first prize in the Kelvinator Comparison contest which was held in connection with the recent Kelvinator Derby sales contest." (Nov. 4, 1931).

"CLEVELAND—More than 600 General Electric refrigerator salesmen who already have qualified for membership in the refrigeration department Toppers' Club, will tour the tropics for a week, beginning Jan. 16, as their reward for sales efforts and accomplishments during 1931." (Nov. 18, 1931).

"CLEVELAND—Art Dunning, distributor of General Electric refrigerators in Duluth, Minn., is the first president of Refrigerania." (Dec. 2, 1931).

"DAYTON—Three executives of business publications, representing the refrigeration, merchandising, and advertising worlds, will be judges in the $6,000 Christmas contest now being conducted by Frigidaire Corp., announces E. G. Biechler, president and general manager." (Dec. 9, 1931).

They Talk It Over At Sales Conventions

Personal contact with the field selling force was maintained to an unusual degree in 1931. More field representatives were added to headquarters staffs, more conferences were held, more conventions were staged.

Almost every month brought a new string of conventions. Chief executives seemed inclined to take dealers and distributors into their confidence in laying plans and mapping campaigns. Close cooperation between factory and field was obtained as a result.

Beginning with the very first issue of the year, the NEWS reported conventions in almost every number:

Jan. 14—More than 700 distributors and dealers attend Copeland sales convention at Detroit, Jan. 12 and 13.

Feb. 11—W. D. Collins, Servel chief engineer, introduces 16 new commercial models at the annual conference of com-

(Concluded on Page 13, Column 1)

The Expansion Valve

By GEORGE F. TAUBENECK

(*Concluded from Page 12, Column 5*)

mercial sales representatives at Evansville, Feb. 2, 3, and 4.

Frigidaire Corp. to conduct sales conferences in 45 key cities during the next three weeks. Six parties of factory representatives leave Dayton for these cities, Feb. 14 and 15.

Feb. 25—Starr Co. holds sales meeting Feb. 13-14 and shows the four 1931 models. Harry Gennett, president; Fred Gennett, secretary; H. J. Wiggins, sales manager, talked. Quick-freezing was discussed by packing company representatives.

Leonard Co. presents 1931 sales plans at a three-day meeting, Feb. 8-10, at the Kelvinator plant, Detroit. A. H. Jaeger, sales manager, presided; emphasis was laid on the two new Leonard models.

March 11—General Electric holds annual "Monitor Top" convention at Cleveland, Feb. 25 and 27, at which time a three-year guarantee was announced. More than 700 distributors, "Toppers," and other members of the organization were present.

March 25—More than 100 leading Frigidaire salesmen come to Dayton for celebration of the tenth anniversary of Frigidaire. Members of the B. T. U. Club, who had made 150 per cent of quota, paraded through the city of Dayton.

Kelvinator and Leonard field representatives assembled in Detroit March 20 through 23. Sales Manager J. S. Sayre, was in charge of Kelvinator meetings. A. H. Jaeger led the Leonard group.

May 20—Norge district sales managers met in Detroit to discuss sales plans last week.

A conference of Mayflower distributors on the national advertising program was held in Dayton, May 14.

One hundred sixty refrigerating engineers and their wives renewed friendships at Kansas City, May 6, 7, and 8, at the national A. S. R. E. convention. A. H. Baer, president, and Glen Muffly and A. W. Oakley, vice presidents, presided over the three engineering sessions.

Aug. 12—Sixty Copeland distributors from all sections of the country gathered for a one-day meeting, July 29, at Mt. Clemens, and were introduced to the new Copeland room cooler.

Fall conventions were reported in the weekly ELECTRIC REFRIGERATION NEWS, as follows:

"DAYTON—Commercial refrigeration development was the main subject discussed at a week's meeting of district representatives of Mayflower electric refrigeration, product of Trupar Mfg. Co., which ended Saturday, Sept. 19." (Sept. 23, 1931).

"CLEVELAND—Plans for an intensive Fall sales campaign on General Electric refrigerators for apartment house installation were laid here recently at the 1931 Apartment House Managers' conference in the Refrigeration Institute." (Sept. 30, 1931).

"EVANSVILLE, Ind., Sept. 29—(Special Wire to ELECTRIC REFRIGERATION NEWS)—All dressed up like Fourth of July was Evansville yesterday and today, as approximately 500 successful distributors, dealers, and salesmen romped into town to attend the first Servel Hermetic convention. . . ." (Sept. 30, 1931).

"CHICAGO—Two hundred and seventy King Kold dealers and salesmen assembled Friday night, Oct. 2, at the factory of the Illinois Moulding Co., to lay plans for the first organized King Kold merchandising drive in the Chicago district, heard the announcement of the company's three-year guarantee, listened to the first of a series of King Kold radio broadcasts, and lent verbal assent to the scheme for an intensive sales drive as outlined by H. E. Richardson, of Young, Lorish, and Richardson, Chicago distributor." (Oct. 7, 1931).

"MANSFIELD, Ohio—Westinghouse intends to get a larger share of the domestic electric refrigerator business during 1932, according to plans laid at a three-day meeting of distributors, held here Oct. 1, 2, and 3." (Oct. 7, 1931).

"DETROIT—Six regional managers and 30 Kelvinator district managers were at the Kelvinator factory Friday and Saturday, Oct. 9 and 10." (Oct. 14, 1931).

"DAYTON—Frigidaire's distributing organization heads, for the United States and Canada, devoted two days to a discussion of current sales activity and the formulation of plans for 1932 at their semi-annual meeting, held in this city, Oct. 14 and 15." (Oct. 21, 1931).

"ATLANTIC CITY, N. J.—Getting an early start in its campaign to boost sales of Electrolux refrigerators in 1932, Electrolux took the center of the stage at the American Gas Association convention, here, Oct. 12 to 16." (Oct. 21, 1931).

"DETROIT—Seven new electric refrigeration models were shown to Leonard distributors at their fifty-first annual convention here, Friday and Saturday, Oct. 23 and 24. These new models, which bear a one-year guarantee, feature 'self-opening' (pedal release) doors, the new Leonard crest, and other cabinet refinements." (Oct. 28, 1931).

"MANSFIELD, Ohio, Nov. 16—(Special Wire to ELECTRIC REFRIGERATION NEWS)—Approximately 65 service engineers, representing practically all Westinghouse refrigerator distributors east of Denver, gathered here today for the National Service Conference of the Westinghouse Electric & Mfg. Co." (Nov. 18, 1931).

"DETROIT, Nov. 22—Announcement of a 6-cu. ft. model, the AH-6, retailing at $237.75, was a feature of the Detroit district Frigidaire meeting, here, this morning. This meeting was one of 43 district gatherings which are being held almost simultaneously." (Nov. 25, 1931).

"MANSFIELD, Ohio—Westinghouse refrigerator advertising for 1932 was explained in detail at a four-day merchandising conference which closed Dec. 12." (Dec. 23, 1931).

New Companies

One of the most interesting features of the 1931 refrigeration year was the rise of small concerns and the entrance of new companies into the field.

Norge made the most sensational rise of all, jumping about 20 places in the comparative rankings. President Howard Blood claims that Norge stands fourth among all refrigeration organizations on the basis of household refrigerators sold during the year.

Mayflower electric refrigerators also showed an exceptionally good gain, as did Williams Ice-O-Matic.

Following the first-of-the-year upheaval at Majectic, wherein dynamic Bill Grunow was ousted, came an alignment of former Majestic men under the Grunow banner. It was announced that Grunow refrigerators and radios would be on the market by midsummer, and the industry pricked up its ears. After several weeks of experimenting and negotiating, however, Grunow locked up his suite of offices and threw the key out the window.

Several smaller companies were acquired by larger during the year. The Apex Electrical Mfg. Co. purchased the refrigeration department of the Wayne Home Equipment Co. in its entirety, continued supplying Wayne electric refrigerators to dealers, and used the Fort Wayne plant for the manufacturing of Apex refrigerators.

The Starr Co. bought a controlling interest in Benedict & Co., Ltd., of Los Angeles, which continued to merchandise its Yukon line of electric refrigerators and distributed Starr Freeze units on the Pacific Coast.

Controlling interest in the Dayton Refrigerating Corp. was acquired by the National Pumps Corp. Baker Ice Machine Co. took over IcElect.

Among the new refrigerators placed on the market was the Tru Kold, which is being sold by Montgomery Ward & Co., through its branches.

Other new companies formed during the year were announced in the editorial columns of early issues of the NEWS, as follows:

Feb. 11—Gibson Refrigerator Co., for many years maker of refrigerator cabinets, announces entry into electric refrigeration field with three models; quantity production to start March 1. Officers of the company are Charles J. Gibson, president; Frank E. Gibson, Jr., vice president in charge of sales; John Lewis, vice president and general manager; and R. E. Wilson, advertising manager.

Feb. 25—Sanitary Mfg. Co., another refrigerator cabinet manufacturer, has started production of a 5-cu. ft. electric refrigerator.

April 22—Mohawk electric refrigerators, assembled by the All-American Mohawk Co., maker of Lyric radios and Wurlitzer organs, have just been placed on the market.

May 20—Designed and developed originally to answer the demand of buyers who wish to put out an electric refrigerator under their own name, a hermetically sealed refrigeration machine is now being marketed by the IcElect Corp., of Omaha, Nebr.

Aug. 12—Lectrik-Ice Corp. is making plans for the appointment of special refrigerator distributors to handle its new household refrigerator, in addition to the 40 distributors now handling its water pumps, softeners, heaters. About 30 refrigerators a day are being made.

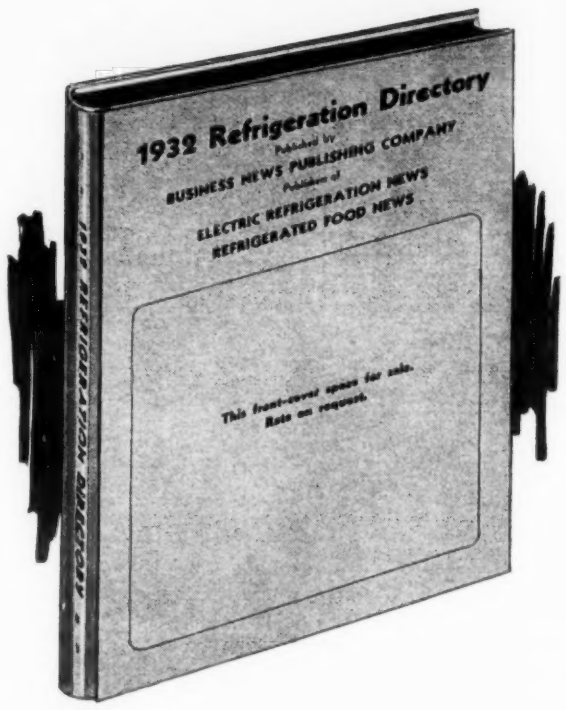
Later news stories include these:

"OMAHA, Nebr.—Announcement was made here last week by J. L. Baker, president of the Baker Ice Machine Co., that the IcElect Corp., manufacturer of electric refrigerators, has been merged into the Baker organization. Albert Schneider, president of the IcElect Corp., joins the Baker staff as engineer in charge of the IcElect division of the Baker Ice Machine Co.

"The Baker Ice Machine Co. has been manufacturing ammonia refrigeration since. . . ." (Sept. 9, 1931).

"JACKSON, Mich.—The Sparks-Withington Co., manufacturer of automobile horns and radio receiving sets, will begin the manufacture of electric refrigerators by Jan. 1, it was announced today by Capt. William Sparks, president of the company." (Oct. 21, 1931).

"LOS ANGELES—Coupled with a two-year guarantee, the new Gilfillan electric refrigerator has made its appearance on the Pacific Coast through dealer outlets of Gilfillan Bros., manufacturers of the Gilfillan radio and now the refrigerator." (Nov. 18, 1931).



Make sure of your facts, figures and names in 1932

Most bargain sales are held after the product has been on the market for some time. But here's a sale before the product is manufactured.

After publication, the 1932 REFRIGERATION DIRECTORY will cost $2.00—a bargain price in itself. But right now, in order to have some indication of how many copies over the guaranteed minimum of 10,000 we should print, we are offering the DIRECTORY at just one-half price—$1.00 per copy, cash with order.

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Here is a convenient handbook, 6x9 inches, cloth-bound, that will merit an accessible location on your shelf of reference books. You will wonder how you kept shop without it. It's classified listing of sources of supply alone will be worth more than the full price of $2.00 to you. Recall how often you have wanted to know something about the industry right at the moment. Make sure you will have a copy handy by taking advantage of the special $1.00 price.

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'Instalment Selling Will Aid Business Recovery'—Vogel

Character of Instalment Paper High, Executive of Trust Corp. Says

By Edwin C. Vogel
Chairman of the Executive Committee, Commercial Investment Trust Corp.

ALTHOUGH in recent years the trend of opinion of economists, bankers, and business men has been toward a definite acceptance of the soundness of instalment selling—yet it has been maintained by some that when a severe depression in business should come, with consequent unemployment, a collapse of outstanding instalment credits might ensue, that finance companies might sustain heavy losses, and that instalment credits might become a financial burden.

It has also been said that instalment selling has caused an undue expansion of purchasing which would cease in a period of business depression, thereby making the depression more severe.

Instalment selling is not a newly discovered or a newly employed system. It has been employed in the sale of such articles as household products, sewing machines, musical instruments, and agricultural machinery since the middle of the nineteenth century and to some extent earlier.

Its importance as a factor in our economic machinery, however, came with the development of the automobile in the early part of the present century; and it has since been utilized in the sale of electrical appliances, refrigerators, machinery, business equipment, and other products.

In order to properly consider instalment selling in its relation to the business depression, I must ask you to bear with me while I first briefly state my impressions of the causes of the depression.

Causes of Depression

Business fluctuations, periods of inflation and depression, have been frequent in the history of our capitalist system. In looking for the causes of the present business condition, therefore, let us not be led astray by a search for something unusual.

Wars, acts of God, overexpansion of industry and speculation in land, securities, and commodities in the past have been the principal causes of similar occurrences. The present is no different from former inflationary and depression periods.

Some believe it different because it affects them personally and because they are, perhaps, surprised either at its occurrence or its severity.

Consequences of War

In my opinion, the underlying causes of our troubles today are the consequences of the World War.

It is due to the war that we have seen great nations, victors and vanquished, impoverished, social and political unrest bringing economic uncertainty, great national and international debts that are an international burden, high taxes, maladjustment of supply and demand, unequal distribution of the good supply, ample credit where it is least needed, but doubts preventing its extension to the countries where is it most needed.

These are some of the consequences of the war and some of the causes of the depression. But the direct cause of the depression was the boom, the frenzy of excessive prosperity of 1929 and the years immediately preceding.

Normal Demands Not Supplied

During the war, factories were diverted from normal peace-time activities, and building construction ceased, except for purposes of war. Normal demands could not be supplied.

After the war, these pent-up demands, added to the demands of peoples and nations whose property had been destroyed and required replacement, developed a great and growing demand, to fill which basic commodity production was largely increased and additions to plant and new manufacturing facilities were created.

Business was vastly increased, fostered by modern scientific methods of management, production, and distribution. All this resulted in overexpansion and overproduction, which is now being adjusted.

Business is a result of human effort, its conduct is guided by man who, unfortunately for himself, is not always calm or clear thinking. He suffers at times from exhilaration and exuberance, and at other times from depression of spirits; and these temperamental and psychical changes influence his action in business.

Suffer from Mass Insanity

Prior to the stock market crash in October, 1929, many men of business suffered from what was near mass insanity, an unreasoning faith in the unending forward march of business, a reckless disregard of warning signals a belief that I heard often expressed by men who are usually normal, sound, and conservative, that we were in a new era in which the old tried and tested economic laws would not apply.

The firmly established rule that high prices curtail consumption was considered a thing of the past. Men were carried away by mounting, though fanciful prosperity. Judgments were warped.

It was this frame of mind, leading as it did to undue factory and business expansion, to frenzied speculation in land and securities without regard to values and with a guileless belief that prices should be based on what values would be a decade hence—it was this frame of mind, this unbelievable optimism, that was the direct cause of the reaction.

We have been suffering the consequences of a boom.

Instalment Selling Recent

Instalment selling is one of the more recent developments that has aided business. There is no doubt that it increases purchasing power, and thereby increases business but, as I shall show later, it is an aid in good times and in bad times, and does not create an abnormal condition.

Labor-saving devices, modern machinery, electrical power development, mass production, scientific salesmanship, and distributing methods, advertising, the Federal Reserve System, bank credit the supply of capital requirements by the investment banker—these have all aided in the development and expansion of business, and in that sense may be said to have contributed to the depression—because, if business had not expanded it would not now be contracting.

Instalment Paper Safe

Any who care to consider these tools of our present day economic development as responsible for the depression may, with equal logic, include instalment selling among the causes, but not to any greater extent than these other forces of economic progress.

Speaking for our own company, I can say unhesitatingly that the experience of the past year and a half has confirmed our faith in the fundamental soundness and safety of instalment paper.

While repossessions and uncollectible accounts have been somewhat greater than in normal times, they have at no time been disturbing.

Other Financial Panics

We did not need this test to be sure. We have been in business since 1908 and have weathered a number of depressions and business and financial disturbances, both local and nation-wide—the depression of 1920, the coal strike in Pennsylvania in 1925, which created wholesale unemployment in a large district, forces of nature adversely affecting large areas at divers times, the Florida land speculation and its collapse.

These and other occurrences long ago proved to our satisfaction that properly created instalment credits were sound and would be paid in accordance with their terms.

Two Small Companies Closed

In answer to my inquiry of Mr. Milan V. Ayres, analyst of the National Association of Finance Companies, he informs me that he knows of only two finance companies that have gone into the hands of receivers since October, 1929, both of which were very small companies.

This record is both remarkable and interesting when we think of the great number of failures in other lines of business activity, and when we realize that during the same period upwards of a thousand banks were compelled to close their doors.

Credit Carefully Checked

I submit that the record of instalment credits during these troublous times compares most favorably with the results of other forms of credit. The experience, however, should not be surprising to anyone.

The purchaser's credit is carefully checked, giving due consideration to the moral hazard, his financial position, his earning capacity, if an employe the length of his employment, his residence and all other questions that are deemed pertinent to the determination of his ability as well as his willingness to pay for the article purchased, and to assure the credit man that he is not purchasing something beyond his means.

A substantial down payment is required, the amount depending upon the character, use and durability of the article sold, the balance being spread in equal monthly payments which must not be too long.

The down payment creates a substantial interest of the purchaser in the article which he will not willing lose, and this keeps him from undertaking the monthly payments required unless he is sure that he is able to meet them.

The critics of instalment selling have a pet phrase. They call it "mortgaging the future," and they also speak of it as "anticipating the purchasing power of future years."

That it does not mortgage the future and that it does not infringe upon the purchasing power of future years must be apparent if we analyze the average time required to make payment for an instalment purchase.

Pay Out of Income

Let us remember, first, that the man who makes an instalment purchase generally knows what he is doing and what he can afford to pay.

The instalment purchase is a convenience, and enables him to make his payments of out income without strain, and the commitment is often made in preference to drawing on savings.

If all instalment purchases were converted into sales on open account credit payable within 130 days from the date of purchase, no one would think of them as mortgaging the future.

Equal to 130 Days' Credit

An obligation to make a down payment of 33⅓ per cent and to pay the balance in 12 equal monthly instalments is equivalent to an open account for the entire amount (without any down payment) of 130 days.

I very much dislike to constantly refer to the experience of our own company, but its facts and figures are most readily available to me and I must, therefore, ask you to pardon me if I again refer to its experience.

The crash in Wall Street came at the end of October, 1929. Of the instalment obligations outstanding on the books of our company on October 31, 1929, 69 per cent were completely paid and liquidated on April 30, 1930, that is within six months, and 95 per cent were liquidated on October 31, 1930, that is within one year thereafter.

It does seem to me that these facts and figures completely and conclusively answer the claim that instalment purchasing anticipates purchasing power for a long period ahead.

Isolated Transaction

An instalment sale usually represents an isolated transaction which is not a repetition of a similar transaction in the immediate past nor likely to be repeated in the immediate future.

The man who buys on instalment credit uses this form of credit as a convenience because it helps him to save; it makes it easy for him to set aside monthly out of his excess income sufficient to pay his monthly instalment.

It teaches him, and has taught large numbers of our American public, how to budget income and expenses. It inculcates the spirit of saving, and develops the habit of thrift.

When a man has completed his instalment purchase, he realizes that he can save a substantial amount out of his income, either for deposit in the savings bank, for acquisition of some desirable and needed article, or for capital accumulation by investment. Instalment selling is fostering financial orderliness in the public mind.

Savings Volume Increased

During the period from 1920 to 1930, in which instalment credits were quite freely employed, the volume of deposits in the savings banks of our country constantly increased. This does not confirm a condition of extravagant spending induced by the instalment method as pictured in the assumptions of our banker friend.

The question has been asked whether instalment selling will greatly increase or greatly decrease in the transition from prosperity to depression or vice versa.

Automobile Finance Figures

The experience of the past would indicate that the percentage of instalment selling to the total sales of merchandise remains almost constant.

While we do not have statistics with respect to all instalment selling, we are fortunate in having reliable figures with respect to automobile sales.

With the development of the motor car, instalment selling increased considerably prior to 1924, since which time the percentage of automobiles sold on instalment credits has varied between 58 and 65 per cent. Year in and year out these instalment sales have averaged slightly more than 60 per cent of the total sales.

The percentage of new automobiles sold on the instalment plan in 1928 was 58.1 per cent, in 1929, 62.6 per cent, and in 1930, 62.3 per cent. These figures cover the period of the great inflation years and the past year of depression.

With these facts before us, it becomes quite apparent that instalment credits are utilized in good times and in bad times just as bank credits and open account commercial credits and retail open account credits are utilized in good times and in bad times.

These credits, one and all, increase in times when business is good and decrease in times when business is bad. They are all an essential part of our business machinery.

As Sound As Any Form

In conclusion, let me say that it is my firm conviction, based upon an experience of many years, that instalment credits properly created are as sound a form of credit as any that we know; that instalment selling has been of great benefit in the development of our industry and has become an essential part of the economic machinery of today; that it has brought to the consumer a convenient method of making payment for what he needs, what he wants and what he can afford to buy; that it has helped him to save and that it has aided him in his cultural development and happiness through the acquisition and enjoyment of many articles, the ownership of which he might otherwise have been compelled to forego.

To single out the exceptions, to abuse and criticize a system by reason of the existence of such exceptions, is unwarranted and unfair. Men must be forward looking.

Courage Needed Today

Today, of all times, courage is needed. It is true that conservatism is the rock upon which prosperity must be built, yet courageous leadership is needed to build upon that foundation.

Those men who, two years ago, were ready to disregard all sound and proven economic laws and who were ready to believe that the apparent prosperity that then existed would continue forever without interruption, are now being heard crying from the housetops that the present depression differs so widely from others that have gone before that it will never end.

Depression Near End

There are, however, many among us, of whom I am one, who believe that we are now at or near the bottom of the depression and that we are at the present time going through a period of readjustment.

Recovery will be slow and we must be patient and use every means at our disposal to aid in the recovery.

During the recovery readjustments will continue. We must find methods of economy in operation, lower costs of distribution, more constant and careful attention to detail, all resulting in lower costs to the consumer.

We will start our upbuilding from a new level and on a strong foundation with prices low, with banks out of debt, with a large supply of gold on hand. I am firmly of the conviction that the present generation will see America in its era of greatest development, power, and prosperity.

Future Instalment Selling

To attain this end, we must employ all the proven tools that we have available, and among those that will be most helpful in restoring business to its normal condition will be the system of instalment selling.

This system will not be a panacea. It will not, of itself, bring back prosperity; but when business starts to recover, it will be of substantial aid in this recovery.

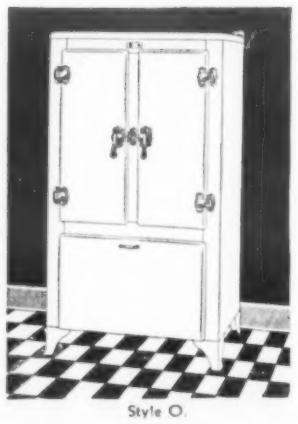
Merchants and manufacturers who will require new and additional machinery and equipment for more efficient and more profitable operation, will be enabled to more quickly purchase such machinery and equipment upon instalment credit, paying for it out of savings and additional profits, and the consumer, with courage restored and employment more certain, will again purchase more readily with the aid of the instalment credit that will be available to him.

Want No More Booms

We want no more booms. They are worse than panics, for at the depths of a depression recovery is on its way, but when we have a boom depression and misery are on the horizon.

In our country, with its great, natural wealth, its sturdy, hard-working, and growing population, its inventive genius, its ability to employ new methods—what we seek is not a boom, but a restoration of a reasonable balance of production and consumption. This is the true "normal," which is a condition of sound prosperity.

OUR MANY OLD CUSTOMERS
Attest the Merits of
THE STARR FREEZE
A large and complete domestic line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Engineered and built complete in our own large factories.
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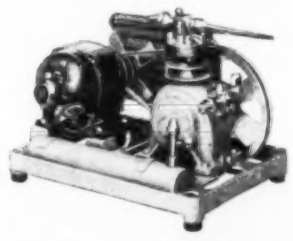

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THE IMITATION FOOD PRODUCTS CO.
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Prices in our catalog of January, 1931, are reduced 20 per cent.

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Manufacturers Specializing in Service to the Refrigeration Industry

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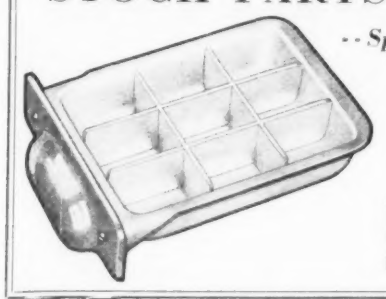

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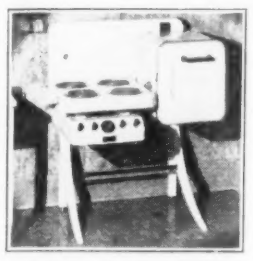

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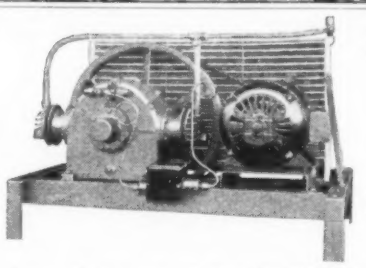

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Export of Refrigerators

October, 1931, Shipments Reported by the Bureau of Foreign and Domestic Commerce

	Electric Household Refrigerators		Electric Commercial Refrigerators Up to 1 Ton		Parts for Electric Refrigerators
	Number	Value	Number	Value	Value
Austria	...	...	2	$ 180	$ 302
Azores and Madeira Islands	1	$ 225	...	...	...
Belgium	20	2,639	5	947	1,695
Czechoslovakia	...	...	2	293	7,025
Denmark	32	2,460	12	1,824	2,973
France	73	3,390	20	2,248	13,303
Germany	1	135	10	1,529	2,595
Gibraltar	...	...	2	1,406	...
Iceland	1	114	...	...	...
Irish Free State	...	...	...	...	18
Italy	17	1,550	10	1,061	2,615
Malta, Gozo and Cyprus	1	123	...	...	13
Netherlands	4	507	6	922	250
Norway	...	...	4	866	59
Portugal	4	667	...	...	...
Spain	18	3,005	3	510	793
Sweden	99	8,522	20	2,659	6,888
Switzerland	3	505	17	2,012	2,638
United Kingdom	157	16,601	25	3,775	13,955
Yugoslavia and Albania	23	2,667	...	...	3,909
Canada	268	32,085	68	22,072	25,065
British Honduras	...	...	...	...	17
Costa Rica	4	573	...	...	363
Guatemala	4	1,014	...	...	1,254
Honduras	3	528	1	350	210
Nicaragua	...	...	...	...	48
Panama	36	6,740	1	180	938
Salvador	1	109	...	...	60
Mexico	33	5,655	3	1,200	895
Newfoundland and Labrador	...	...	...	...	27
Bermudas	19	2,653	...	...	717
Barbados	4	516	1	130	40
Jamaica	14	2,517	...	...	45
Trinidad and Tobago	1	116	...	...	2
Other British West Indies	3	406	...	...	436
Cuba	133	18,423	8	2,330	1,869
Dominican Republic	9	1,081	...	...	30
Netherland West Indies	3	448	5	1,378	2,688
Haiti, Republic of	7	1,064	...	...	30
Virgin Islands of U. S.	...	...	...	...	45
Argentina	112	12,152	10	1,763	11,060
Brazil	153	17,810	31	4,324	2,002
Chile	5	605	...	...	509
Colombia	63	8,433	2	569	760
Ecuador	1	98	...	...	5
British Guiana	...	...	...	...	691
Peru	13	1,489	14	1,767	736
Uruguay	14	913	15	1,798	3,802
Venezuela	16	1,812	4	1,089	1,608
Arabia	...	...	...	...	30
British India	13	1,234	4	594	6,608
British Malaya	24	3,097	7	1,234	471
Ceylon	12	1,748	2	423	544
China	4	338	9	614	876
Java and Madura	40	5,228	6	1,304	1,186
Other Netherland East Indies	2	245	2	722	334
Hong Kong	6	838	1	84	492
Japan	16	1,797	6	871	257
Philippine Islands	175	27,992	13	3,869	2,154
Siam	8	943	...	...	120
Turkey	8	1,001	...	...	15
Australia	...	...	5	355	501
French Oceania	1	100	...	...	...
New Zealand	14	1,360	12	1,507	393
Belgian Congo	...	...	...	...	2
British East Africa	...	...	2	349	298
Union of South Africa	611	93,315	19	3,321	12,563
Nigeria	12	794	...	...	186
Egypt	3	440	...	...	319
Algeria and Tunisia	...	...	...	...	750
Madagascar	6	1,080	...	...	...
Other French Africa	5	611	...	...	...
Morocco	100	10,107	2	234	915
Mozambique	3	451	...	...	59
Canary Islands	...	...	...	...	32
Total	2,436	$313,069	391	$74,663	$144,088
Shipments to Hawaii	331	74,171	31	6,584	5,277
Porto Rico	226	35,029	7	1,560	1,382

REQUESTS FOR INFORMATION

Readers who can be of assistance in furnishing correct answers to inquiries, or who can supply additional information, are invited to address Electric Refrigeration News, mentioning query number.

Spear Water Cooler Co.

Query No. 618—"What is the address of the Spear Water Cooler Co.?"

Answer—The business has been taken over by Richmond Engineering Co., 2916 Richmond St., Philadelphia, Pa.

Compressor Manufacturers

Query No. 619—"What companies manufacture compressors?"

Answer—Baker Ice Machine Co., Omaha, Nebr.; Brunner Mfg. Co., Utica, N. Y.; Kulair Corp., Finance Bldg., Philadelphia, Pa.; Merchant & Evans, 2035 Washington St., Philadelphia, Pa.

Replacement Parts

Query No. 620—"What companies manufacture standard compressor replacement parts and coils for Frigidaire and other makes of electric refrigerating machines?"

Answer—Frigidaire Corp., Dayton, O.; Kerotest Mfg. Co., Pittsburgh, Pa.; Chicago Refrigeration Co., 217 E. Illinois St., Chicago, Ill.; Tigar Corp., 211 Second St., Chelsea, Mass.; Iceless Refrigeration Accessories Co,, 2401 Chestnut St., Philadelphia, Pa.; Refrigeration Service, Inc., 3109 Beverly Blvd., Los Angeles, Calif.

Copper Tubing

Query No. 621—"We are interested in securing a source of supply for copper tubing bands made of ⅜-in. O. D. x 20-gauge copper tubing. Who can furnish this to us?"

Answer—Wolverine Tube Co., 1411 Central Ave., Detroit, Mich., will furnish tube according to specifications.

THE CONDENSER

ADVERTISING RATE fifty cents per line (this column only).

SPECIAL RATE is paid in advance—Positions Wanted—fifty words or less, one insertion $2.00, additional words four cents each. Three insertions $5.00, additional words ten cents each. All other classifications—fifty words or less, one insertion $3.00, additional words six cents each. Three insertions $8.00, additional words sixteen cents each.

REPLIES to advertisements with box numbers should be addressed to the box number in care of Electric Refrigeration News, 550 Maccabees Building, Detroit, Mich.

POSITIONS AVAILABLE

WANTED—Man experienced in design and construction of all types of commercial cabinets and display cases in conjunction with electric refrigeration. Give complete details as to education, past experience, references and salary expected in first letter. Box 402.

DISTRICT MANAGERS with fast-growing manufacturer requiring diligent, self-governing, reliable men, experienced in commercial and domestic refrigeration sales, able to show sound credentials from field and former employers. Must have personality, initiative, diplomacy and tact. Wholesale sales to distributors and dealers. A chronological resume of former connections, results and following, also desired method of compensation and amount should be stated in your reply. Box 406.

POSITIONS WANTED

WANTED—Connection with manufacturer's branch or big distributor for domestic and small commercial refrigerating machines. Sixteen years' experience in organization, sales, installation, and service methyl chlorite, sulphur dioxide, and ammonia to two-ton capacity. Thoroughly understand all branches and amply able to assume all responsibilities. Prefer drawing account to commissions. Box 403.

BUSINESS OPPORTUNITIES

NEW Refrigerator COIN METER PATENT, featuring simplicity and low production cost, for sale on royalty basis. An unusual opportunity for anyone interested in investing: a company desiring to add a new product to their present line, or refrigerator companies intending to manufacture coin meters for their own sales purposes. Box 404.

POSITION AVAILABLE

WANTED: Refrigerating Engineer. The man we are seeking must be thoroughly versed on Domestic Refrigeration and of a creative nature. Full details as to past experience, age and salary expected must be given in application.

Box 405 Electric Refrigeration News

CONVENIENCE GOODS SOLD ON PULLMAN CARS

WASHINGTON, D. C.—Retailing has been extended even to sleeping cars, the U. S. Department of Commerce points out.

Display cases on sleeping cars have been installed containing convenience items, such as tooth brushes, cosmetics, collar buttons.

GENERAL ELECTRIC DEALER OPENS NEW STORE

EAST LIVERPOOL, Ohio—Frank C. Williams, General Electric dealer, recently opened his new electric appliance store in W. Fifth St.

SUBSCRIPTION ORDER

Business News Publishing Co.,
550 Maccabees Bldg.,
Detroit, Mich. 1932

Sirs:

Please enter order for subscriptions as follows:

☐ Electric Refrigeration News only ☐ 1 year ☐ 3 years.

☐ Refrigerated Food News only ☐ 1 year ☐ 3 years.

☐ The 1932 Refrigeration Directory (Book to be issued Feb. 1).

☐ Electric Refrigeration News and Refrigerated Food News. Combination rate for both papers ☐ 1 year ☐ 3 years.

SUBSCRIPTION RATES (Effective Jan. 1, 1932)	Electric Refrigeration News		Refrigerated Food News		BOTH PAPERS	
	1 Yr.	3 Yrs.	1 Yr.	3 Yrs.	1 Yr.	3 Yrs.
In United States and Possessions and all countries in Pan-American Postal Union	$3.00	$7.50	$1.00	$2.50	$3.50	$8.00
In Canada (where new tariff of 5 cents per copy applies). Payment in U. S. money.	$6.00		$2.00		$7.00	
All other countries	$4.00	$10.00	$1.50	$4.00	$5.00	$12.00

The 1932 Refrigeration Directory. Special pre-publication offer for month of January only: $1.00 in United States, $1.50 in all other countries.

Name.....

Attention of or care of.....

Street address.....

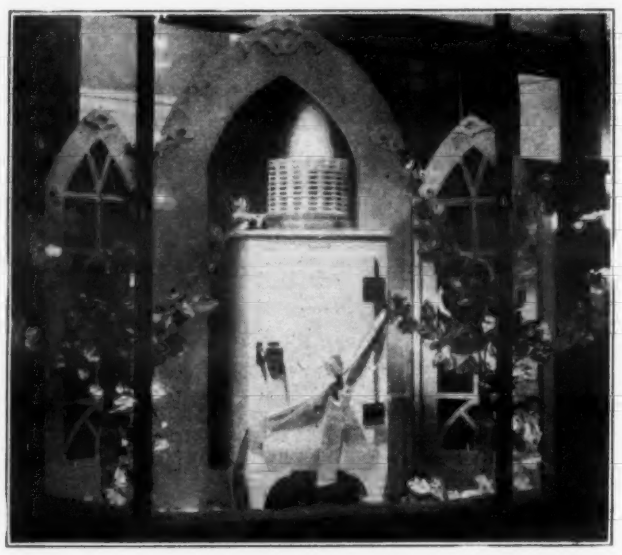
City and state.....

12-30-31

Holiday Activities of Refrigeration Organizations

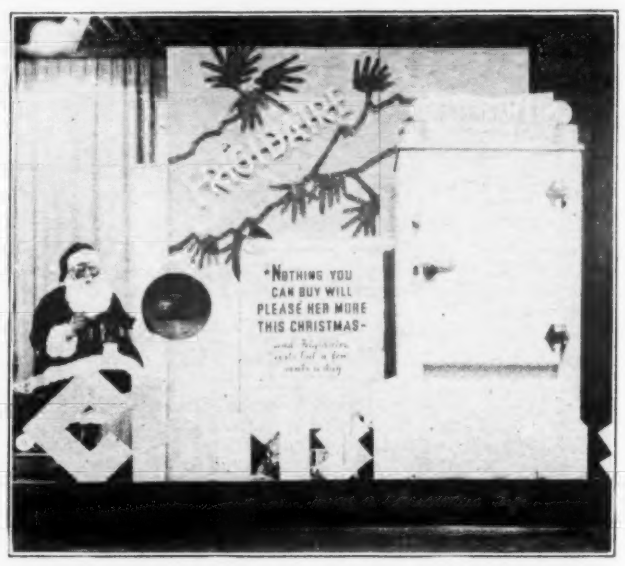
Ten executives of Commonwealth Edison Co., Chicago distributor, visited the Kelvinator plant recently in company with H. A. Dahl, regional manager, and T. H. Maginnis, district manager.

Ice-O-Meter Sales Co., 2216 S. Michigan Ave., Chicago, is a new metropolitan dealer for Copeland electric refrigeration. C. W. Thayer is president of the company.



The photograph shows a General Electric Christmas window display used by the Montana Power Co., Billings, Mont.

Electric heaters were used in a window display of Rorabaugh-Wiley's, Hutchinson, Kans., to show the cold retaining qualities of the Norge.

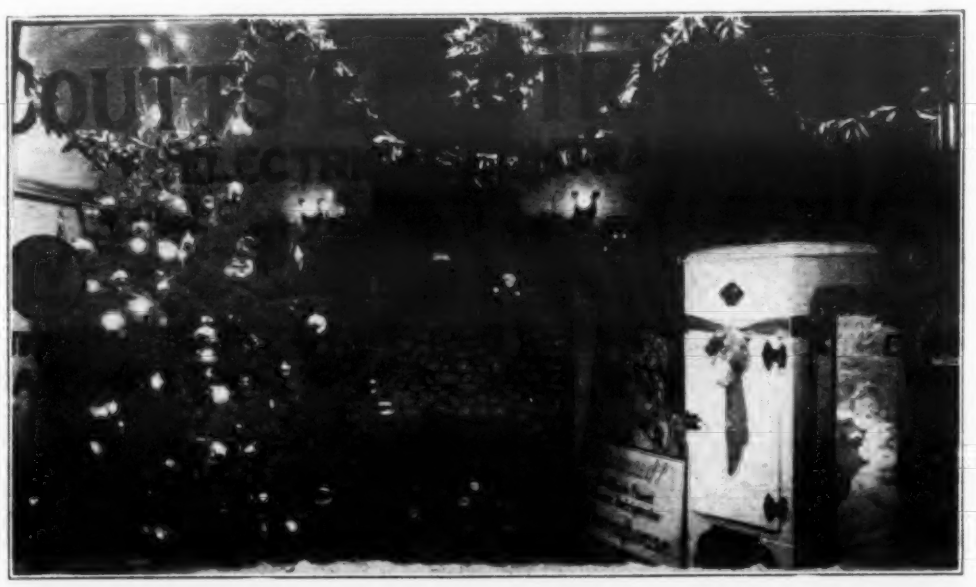


Santa Claus and a Frigidaire were used in this window display previous to the Christmas holidays.

Christmas morning with the family around the Christmas tree and the maid in the kitchen was depicted in the General Electric window display of Storz Electric Refrigeration Co.

Many prospects were attracted to the Edwards Piano Co., Kelvinator dealer in Jacksonville, Fla., by the window display which featured a Model S-9.

An immaculately set dinner table with panels depicting Christmas in the background was the center of the electric refrigeration bureau display of Frigidaire Sales Corp., New York City.



Another entry in the national display contest is the window of Coutts Electrical Co., Perth Amboy, N. J. The display was designed by Samuel Fertig, Westinghouse salesman.

Written to be Read On Arrival

Engineering Section

In Two Parts Part Two

ELECTRIC REFRIGERATION NEWS

Registered U. S. Patent Office

The business newspaper of the refrigeration industry

ISSUED EVERY WEEK
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DETROIT, MICHIGAN, DECEMBER 30, 1931

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TEN CENTS PER COPY
TWO DOLLARS PER YEAR

WAREHOUSE FOR CABINETS OPENED BY G. E. AT ERIE

$300,000 Unit Finished; Centralization of Work Started

CLEVELAND—Another step in the plans of the General Electric Co., to concentrate all refrigeration manufacturing in Erie, Pa., has been completed, it was announced a few days ago by A. M. Sweeney, manager of refrigeration production, as the new $300,000 refrigerator cabinet warehouse at Erie was placed in use.

For two years the company has been working toward centralization of refrigerator production, and now, all refrigerator cabinets are manufactured in Erie. Compressor units are made in Schenectady, N. Y., and Fort Wayne, Ind. As conditions warrant the move, however, it is planned that the production of compressor units also will be concentrated in the Pennsylvania city.

The new warehouse, construction cost of which was lower than any building the General Electric Co. has ever erected for its own use, officials state, is 400 ft. long, and 350 ft. wide, with a storage capacity of 70,000 cabinets.

The steel framework was electrically fabricated, welding having been done in the shop and field with General Electric welding equipment. Completion of the warehouse and laying of additional railroad trackage, spurs, etc., was one of the fastest construction jobs ever performed by contractors for the General Electric Co.

The refrigerator cabinet plant at the Erie works has one of the most modern conveying systems ever designed, Mr. Sweeney claims.

"An important feature of this system is the photo-electric cell. After the crated cabinets leave the assembly line and enter the warehouse, the width of the crates determines, through the 'electric eye,' the storage space to which they are conveyed. Thus, the photo-electric cell performs the task of sort-

(Concluded on Page 16, Column 5)

WILSON-MAEULEN DIVISION MERGES WITH FOXBORO CO.

FOXBORO, Mass.—The pyrometer division of the Wilson-Maeulen Co., Inc., has just merged with the Foxboro Co., according to Foxboro officials.

The entire personnel of the pyrometer division of Wilson-Maeulen Co. will be merged with that of the Foxboro organization.

The Wilson-Maeulen Co. manufactures electric indicating, recording and controlling pyrometers, and electric resistance thermometers for temperatures up to 3,600° F.

The Rockwell hardness tester formerly manufactured by the Wilson-Maeulen Co. will hereafter be built and sold by the Wilson Mechanical Instrument Co., which succeeds the mechanical instrument division of Wilson-Maeulen and continues in the same factory and offices at 383 Concord Ave., New York City.

Pyrometers and controllers will be built in the local factories.

CARRIER SYSTEM INSTALLED IN OAKLAND THEATER

OAKLAND, Calif.—The handsome new Paramount Theatre, a 3,500-seat house opened Dec. 16, is equipped with the Carrier system of manufactured weather, the installation having been made by the Carrier Engineering Corp. of California. The installation is one of the first of its kind in the San Francisco Bay region.

The system is fully automatic, and includes a 150-ton refrigeration machine. It handles 200,000 cu. ft. of air per minute.

To operate the cooling and air conditioning system, about 300-hp. of power is required. Air in the lobbies, foyers, offices, and all public rooms is conditioned, as well as that in the auditorium and dressing rooms. The contract, valued at about $100,000, was handled by R. A. Kroeschell of New York, who heads the theatre division of the Carrier Engineering Corp.

Universal Cooler Names Burnside Plant Head

DETROIT—H. D. Burnside has been named production manager in complete charge of manufacturing at the new plant of Universal Cooler Corp., at Solvay, Melville, and Green Ave. S., here, according to J. W. Taylor, vice president.

Prior to joining the Universal Cooler organization on Nov. 1, Mr. Burnside was connected with the Clark Equipment Co., of Battle Creek, Buchannan, Jackson, and Barrien Springs, Mich.

For the past 11 years he was in charge of their Battle Creek plant, which was built under his direction and operated under his supervision until he joined Universal Cooler, Mr. Taylor states.

Mr. Burnside has specialized in general factory management, wage incentive plans, material control, and other problems of industrial management.

CONTROL DEVELOPED BY GENERAL ELECTRIC

SCHENECTADY, N. Y. — General Electric Co. has just announced details of its new type CR1057-BI control for the compressor motor on alternating current domestic electric refrigerators.

The new control incorporates an "on-off" switch, the "off" position being used for defrosting; a thermal overload device to protect the motor against sustained overloads; a knob for manually resetting the relay; and an adjusting knob for varying the temperature in the food chamber; as well as a flexible metallic bellows and tube, the end of which is to be mounted on the evaporator or coil.

The unit is designed for mounting either on a standard or on the evaporator plate inside the refrigerator. It may also be flush mounted on the outside of the cabinet.

The bellows and tube in the new control unit are filled with sulphur dioxide or methyl chloride, either of which liquefies at low temperatures and becomes gas at high temperatures, the percentages in liquid or vapor state depending upon the temperature and the pressure to which they are subjected.

The ends of the bellows tube must be securely fastened to the evaporator, or coil, in order that contact will be made at least 3 in. above the sealed end, General Electric engineers state. In installing, the unit is mounted so that, upon liquefying, the agent used will condense in the end of the tube in contact with the evaporator.

The switch, which connects and disconnects the compressor motor from

(Concluded on Page 4, Column 3)

Directs Expansion

A. M. SWEENEY
General Electric works manager announces warehouse completion.

SMITH CO. DEVELOPS MINERAL INSULATION

SPRINGFIELD, Ill.—The Geo. B. Smith Chemical Works, a local plant here, has devised a method of fabricating vermiculite into an insulation for electric refrigerators, according to F. K. Smith of the company. The new insulation has been termed "Micro-sel."

"Vermiculite is of a micaceous nature," Mr. Smith says, "consisting principally of magnesium, silicate, and aluminum. Its most pronounced characteristic is that of expanding from 10

(Concluded on Page 16, Column 4)

Comparative Tests of Refrigerants

The commonly used refrigerants were subjected to a series of comparative tests on Oct. 28 and 29 by the Jackson Laboratory of Kinetic Chemicals, Inc., Deepwater Point, N. J., and witnessed by refrigerating engineers, as reported in Electric Refrigeration News, Nov. 4. In this issue will be found a complete technical report of the tests.

American Radiator Sales Centralized In Detroit Office

DETROIT—Beginning Jan. 1, the sale of all refrigeration products of the American Radiator & Standard Sanitary Corp. will be handled by the Detroit Lubricator Co., a division of that company, according to I. J. Knudson, refrigeration sales manager.

This includes American Castincoil domestic evaporators which have been handled jointly by the Detroit Lubricator Co. and the industrial division of the American Radiator Co. at Chicago, and the cube-makers and the American cast iron cooling sections for commercial installations.

Mercoid products will also be sold by the Detroit firm under the new arrangement, Mr. Knudson announced. This line includes Mercoid pressure and tem-

(Concluded on Page 2, Column 5)

CHICAGO FIRM BUILDS TWO TRUCK SYSTEMS

CHICAGO—Two sizes of a mechanical refrigerating system have been designed by Safety Refrigeration, Inc., for cooling refrigerated trucks, according to Horace M. Wigney, manager of the company. This firm is a subsidiary of the Safety Car Heating and Lighting Co. of New Haven, Conn., which builds cooling equipment employing the Silica-Gel adsorption system for refrigerated freight cars.

The equipment is of the gasoline-engine driven type, with the complete condensing unit designed for mounting in a chamber suspended below the truck body. The condensing unit includes the engine, compressor, condenser, oil trap, starter motor, automatic choke, spark coil, and fan for cooling the condenser.

Thermostatic control keeps body temperatures uniform, Mr. Wigney claims, through automatic control apparatus furnished by the Cole Electric Products Co. of Long Island City, N. Y.

Automatic starting and stopping of the gas engine are afforded by action of the control devices which are enclosed in a weather-proof steel cabinet under the truck body, and accessible from one side. The truck driver has easy access to the main pilot lock switch which is operated by key only to reduce tampering by unauthorized persons, engineers of the company show.

Gasoline is supplied by gravity from the main fuel tank to the carburetor of the engine except when the tank is so located that gravity feed is impossible. In this case, Mr. Wigney explains, an

(Concluded on Page 16, Column 2)

AIR CONDITIONING SYSTEM PLACED IN NEW STEAMER

B-K, Carrier Engineers Design Equipment For Liner

NEW YORK CITY—The new S. S. Mariposa, which will enter the Matson Line service between the Pacific Coast, the South Sea Islands, and Australia in February, and now nearing completion at the Fall River yards of the Bethlehem Shipbuilding Corp., will have its own air conditioning system to provide manufactured weather to the dining salon.

In all seasons and in all trades, at the equator or in the Northern circle, atmospheric conditions in the dining salon will be automatically maintained from 75 to 80° F., with 50 per cent relative humidity, according to claims of Brunswick-Kroeschell, engineers who planned the installation, under supervision of the Carrier Engineering Corp.

This development in steamship comfort was first adopted on H. M. S. Victoria, built in England last year for the Trieste-Alexandria service of the Lloyd Triestino Line. The United States Lines was the first American company to decide to employ air conditioning on its steamers, its two new cabin liners now being constructed at Camden, N. J., being equipped with Carrier air conditioning systems. The Mariposa, however, will be the first American air conditioned vessel actually in service, Carrier engineers say.

While only the dining rooms on these vessels will be supplied with manufactured weather, the engineers who laid out and installed the systems believe

(Concluded on Page 13, Column 1)

NEW COOLING UNIT DEVISED BY SAWYER ENGINEERING

MILFORD, Conn.—The Sawyer Engineering Co., recently incorporated, announces development of a new type of cooling unit. Positive humidity control, the use of a fan for air circulation, automatic frost control, and elimination of baffles and drip pans are features of the unit, according to J. K. Sawyer, president.

Known as the Humidi-Cooler, it is designed particularly for commercial installations.

The entire unit is enclosed in a housing of .050-in. brass, tin dipped, 24 in. high, 20 in. wide and 15 in. deep. A special 16-in. fan is operated by a Century 1/30 hp. motor, supported by aluminum cast as an integral part of the frame.

The coil is made up of ½-in. OD copper tubing. Louvres are adjustable. The

(Concluded on Page 13, Column 3)

MAURY NAMED PRESIDENT OF ARCO CO.

CLEVELAND—Philip L. Maury has been named president of the Arco Co., manufacturers of enamels, lacquers, and paints for electric refrigerators, to fill the vacancy occasioned by the retirement of S. D. Wise, former president.

Mr. Wise entered the employ of the Arco Co. in 1889 as office boy, within 12 years becoming president which position he held until his retirement Dec. 1.

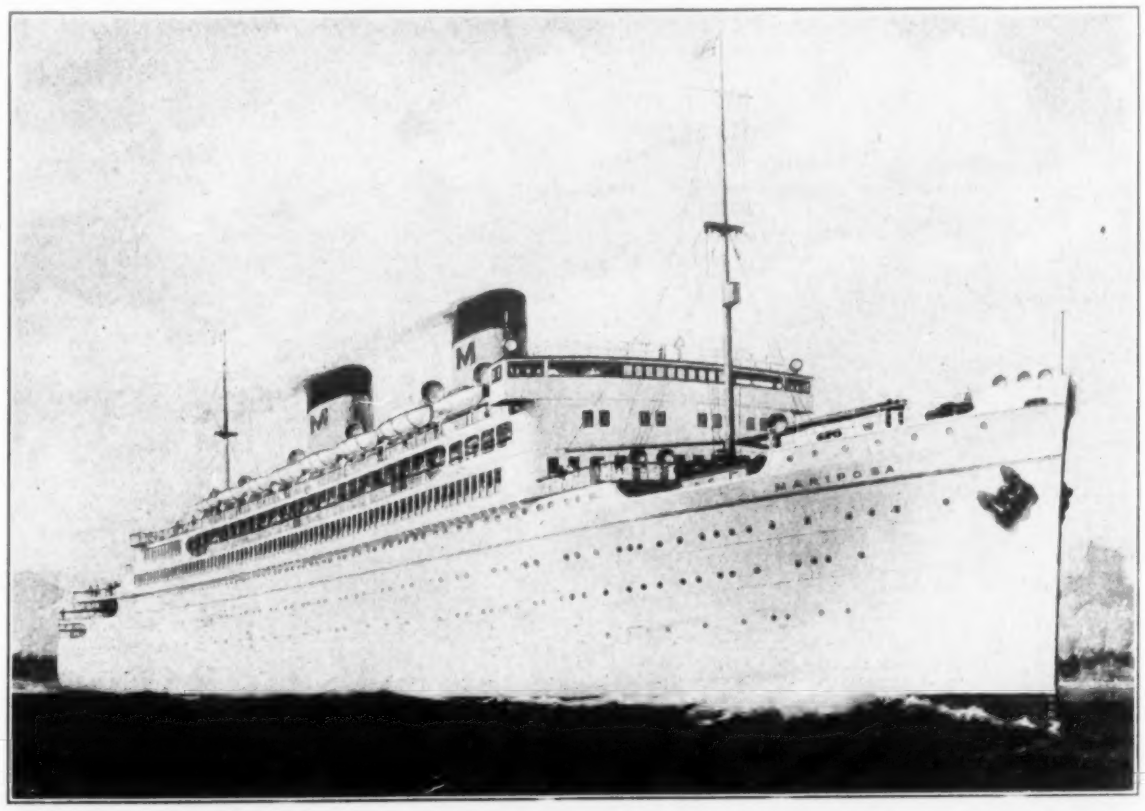
The new president, Mr. Maury, has been connected with the Sherwin-Williams Co., the Detroit Graphite Co., and was vice president of Valentine & Co., New York, until he made the Arco connection.

BEDELL ENGINEERING BUYS NEW FACTORY SITE

LOS ANGELES—The Bedell Engineering Corp. manufacturers of electric refrigeration equipment, formerly at 2869 W. Pico Blvd., Los Angeles, have recently acquired property at Santa Fe Ave. and Fifty-Fourth St. for a new factory covering approximately 20,000 ft. of floor space.

The new move, according to report, is the result of increased business necessitating more space than was possible at the former plant, and involves a consideration of $35,000.

And Now—Air Conditioned Liners



The new steamship Mariposa, which will shortly enter service on the Matson line between the Pacific Coast, Australia, and the South Sea Islands, will have a Brunswick-Kroeschell system for air conditioning the dining room.

SERVICE MEN URGED TO EMPHASIZE CYCLE

MANSFIELD, Ohio—Continually stress the cycle of refrigeration, J. F. Hendrickson, Westinghouse service manager for the Northwestern division, urged in his talk on "Dealer Training" before the Westinghouse National Service Conference, here, recently.

Men in attendance at field service schools are primarily mechanics, he pointed out, and not practiced students. Hence it is important to use language which they will understand.

Query Only the Experienced

"When you have a group with two or three who are more familiar with refrigeration than the rest, make your talk fit the experience of the less informed, calling on the more experienced ones to answer questions."

Don't talk more than 15 minutes at a time, he warned, but intersperse your remarks with practical demonstrations, because the eye is faster than the ear, and the men are more apt to grasp what you show them than what you tell them.

Make a friendly presentation. Do not make them nervous by pointing to one and then another rapidly for answers to your questions.

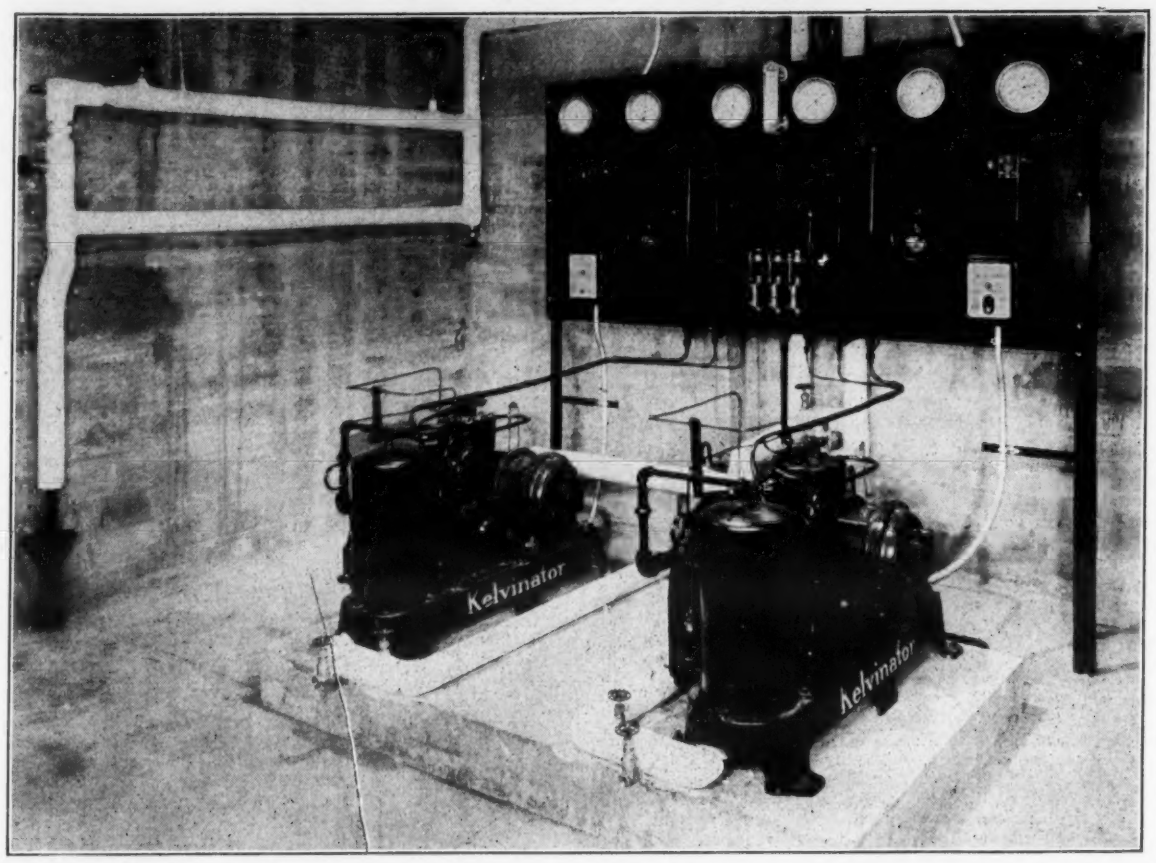
Help Weak Students

"Start in the school to analyze your men. Pick out the weak ones and work with them. Built them up if possible. If they can't qualify, take steps to have them replaced," he maintained.

"Written examinations do not prove how well you have put your story across. Try oral examinations at short intervals throughout the day so you may judge by both, because some men can talk, while others can write," he suggested.

Mr. Hendrickson concluded his talk by stressing the importance of proper appearance of the service man, and intelligent handling of customers.

Neat Installation in Hospital



Two model WR-41 Kelvinator compressors operate two XO-140 triple cross section cross-fin coils for cooling a nine subject mortuary box in the Brooklyn State Hospital, Creedmore division, Queens, Long Island, N. Y. The order was obtained by Albany Garage, Kelvinator distributor in Albany, but the installation was done by the New York branch. Because New York state requires an emergency compressor, two were installed; one serves while the other idles. All valves are by-passed; all water lines are insulated; the panel board is of slate.

COMMITTEE STUDIES WAREHOUSE PROBLEM

MANSFIELD, Ohio — Although the warehousing of refrigerators by distributors is largely a local problem to be solved with especial attention to local conditions, C. Singer, of the Elin Co., Philadelphia, Pa., pointed out a number of helpful considerations in presenting the report of the committee on "Warehousing and Stocks" before the Westinghouse National Service Conference, here, recently.

Mr. Singer gave his report as chairman of the Warehousing and Stocks committee, which included also E. B. Moore of Tafel-Williams, Cincinnati; Gilbert Zimerle, of the Westinghouse Electric Supply Co., Toledo; and Howard Sieggen, of the Columbian Electric Co., Kansas City, Mo.

"Cabinets and units should be placed and grouped according to models as far as possible," he said. "DeLuxe models should be stored singly and upright, while WL-45 and WL-73 models may be double decked upright."

He urged that one person in an organization be held responsible for all cabinets and units in storage, and recommended that old stock be moved out ahead of new stock, if possible, keeping the new in front of the room and the old in the rear for delivery convenience.

"Uncrated cabinets should be properly covered with a pad or paper envelope," he said. "The Larmac carrier is suitable for moving the cabinets around the warehouse."

The maintenance of a stockroom is essential for spare parts, Mr. Singer declared, with one man in charge of it. Bins should be built to take care of all unit and cabinet parts, but they should be made flexible so as to be susceptible to revisions for new parts. Inventories should be taken regularly, he pointed out, and stocks kept up.

The committee also recommended that the service man be charged with parts taken out of stock, and when he returns them, he be credited with the defective part and a record made of the part and the installation where it was used.

He then cautioned the assembled service managers against "robbing" one cabinet or unit of parts for another, saying that if it is necessary to remove a part from a machine, a tag should be attached to the cabinet or unit, telling where the part was used and giving the number of the order which is to replace it.

Mr. Singer concluded his talk with a plea for cleanliness of the warehouse, pointing out that it is one of the best indications of how well the warehousing job is being done.

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ALSO PRODUCING A COPPER COATING INSIDE AND OUTSIDE

STEEL TUBING

INQUIRIES INVITED

BUNDY TUBING CO.
DETROIT MICHIGAN U·S·A

$15,000 HOME OWNERS CONDITIONING PROSPECTS

NEW YORK—"Any individual who spends as much as $15,000 for the lot, house and furnishings which constitute his home should be willing to spend just 10 per cent more for air conditioning.

"For the $15,000 he obtains a veritable Sahara desert in winter and Hades in summer. For the added 10 per cent he can transform his home into a thoroughly pleasant place in which to live and entertain."

So declared W. D. Jordan, president of the Air-Control Systems, Inc., of Chicago, manufacturer of the Zephyr air washers, at a meeting of Zephyr distributors and salesmen in New York recently. He spoke in the offices of the Modern Home Utilities Co., recently appointed Zephyr distributor for New York City and the metropolitan area.

Jordan laid emphasis on his belief that "air conditioning will become the biggest industry of the twentieth century." Urging that salesmen become convinced of the merit of humidifying units before attempting to go out and sell, he pointed out that the first year would be one of selective markets.

The man who has bought an oil burner, electric refrigerator, or other modern accessories, he argued, has shown a willingness to provide comfort and convenience for his home and forms the initial list of live prospects.

In the unlimited market of private offices, Jordan cited cases where employers had justified the purchase price of a humidifying and cooling unit by actual measured increased efficiency in the performance of office workers.

To fortify his contention that air conditioning would soon become as necessary to the ordinary home as are present-day electric refrigerators and modern bathrooms, Jordan cited the active interest in air conditioning of the electric industry, the copper companies, the heating and ventilating industry, the refrigeration manufacturers, health organizations, and other groups affected by the new development.

At the close of his address, the operation and construction of a Zephyr unit was demonstrated by Mr. Jordan and Roger Kopp, eastern representative of Air-Control Systems. H. T. Richardson, president of the Modern Home Utilities Co., was in charge of the meeting, and Wallace R. Linton, vice president, introduced the speaker. Representatives of various other groups attended.

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For Refrigerators & Water Coolers
Send for booklet on complete line of faucets, bubblers, glass fillers, etc.
CENTRAL BRASS MFG. CO.
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CLEVELAND OHIO

HCL SOLUTION WILL CLEAN CONDENSER WATER COILS

DETROIT—To remove the lime and other minerals that accumulate in condensers operated in some cities, Kelvinator engineers have suggested, through the *Kelvinator Service News*, that field men use the following treatment:

1. Remove the condenser and liquid receiver assembly to the shop, and pour into the water coil a solution of 10 per cent hydrochloric or acetic acid and 90 per cent water (by volume), a small amount at a time, until foaming ceases.

2. Then flush the coil thoroughly with clear water. They stress the importance of not leaving the acid solution in the water coil overnight or for any material length of time, because it may be detrimental to the copper coil.

ZEPHYR AIR CONDITIONING CO. ORGANIZES IN NEW YORK

NEW YORK CITY—Anticipating a rapid increase in public acceptance of air conditioning units for the home, office and small stores, the Modern Home Utilities Co., distributors of Zephyr air conditioners in the New York metropolitan area, have just announced the completion of their dealer organization in Westchester County, New York.

ARCO REFRIGERATION SALES CENTRALIZED IN DETROIT

(Concluded from Page 1, Column 4)

perature controls, solenoid valves for refrigerant and water lines, and the new Arcostats (open contact controls for room cooling work).

American automatic expansion valves, thermostatic valves, and float valves, both high and low pressure types, will continue to be handled by the Detroit Lubricator Co.

NEW SERVICE ORGANIZATION STARTED IN LOS ANGELES

LOS ANGELES—The National Refrigeration Co., F. Smith, president, recently located its headquarters at 5132 Santa Monica Blvd., where it is engaging in maintenance and repair work. H. V. Burkhardt is associated with Mr. Smith as engineer.

INSPECTION REDUCES TROUBLES IN FIELD

MANSFIELD, Ohio—Speaking before Westinghouse service managers from all distributors east of Denver assembled for the annual Service Conference, C. W. Mihle, chief inspector of the Westinghouse Electric & Mfg. Co., at East Springfield, Mass., expressed the purpose of the inspection department as that of controlling quality in the manufacture of refrigerators so the least possible amount of trouble will be experienced with them in the field, and seeing that the product is shipped according to engineering design.

"Starting with the parts and materials received from outside suppliers, attention is given to quality of the supplies from the mechanical, electrical, and chemical standpoints," he said.

Specimens are taken from each incoming shipment of metal, analyzed, and not released for production until approved by the inspection department, according to Mr. Mihle.

Check Machine Set-ups

In addition, inspectors regularly traverse the production line to check machine set-ups and to watch the material being turned out by the workers.

"Payment of incentive workers is controlled by the inspection department in that their time cards must be approved by the inspection department before wages are paid, and in some cases deductions are made for spoiled materials," he explained.

Before final assembly of the refrigerators, centralized inspection is made of all parts manufactured, with precision instruments which, in the case of the seisoptometer, are accurate to as low as .00005 in., he claimed. "These instruments are checked periodically during the day by standards which are guaranteed to be correct to within seven one-millionths of an inch.

Measure Pistons, Cylinders

"Pistons and cylinders are measured and classified into six classes, each within .0002 in. variation. Parts in each group are marked 1, 2, 3, etc., by an electric etcher so that a class 2 piston will be matched with a No. 2 cylinder, etc.," Mr. Mihle said. "Each wrist pin is individually fitted to its connecting rod."

A material known as Nitralloy is used for crankshafts, and crank pins are nitrited to produce a hardened mirror surface, he explained. When these parts do not come up to standard on the special testing instrument used on them, they must be scrapped because their hardness prevents reworking.

Small Details Inspected

"During the final assembly, 'floating' inspectors check for small details, such as tightness of screws and cleanliness of parts. Small parts are kept in white porcelain pans so they be kept free from dirt and seen easily for inspection," he stated.

Turning to the process of dehydrating and evacuating the assembled units at the Springfield plant, Mr. Mihle explained that the units are placed in large ovens and attached, by groups, to manifolds connected to vacuum pumps and recording instruments.

Minimum of Moisture

"The entire time of one man is devoted to checking the instruments in this operation, and he has the authority to shut down movement through the ovens should any difficulty appear," Mr. Mihle declared.

After dehydration and evacuation, the units are charged with pre-tested oil and sulphur dioxide so they should contain a minimum of moisture, he continued. When a 24-hour run has been completed on a batch of machines, a sample of sulphur dioxide is taken from one unit of each manifold group and analyzed; should the moisture content exceed specifications the whole group is rejected and goes back to the production line for reworking. Before crating, all units are checked twice for refrigerant leaks in an atmosphere of ammonia, he explained.

The final performance test includes temperature readings on all units, and also checks on both high and low side pressures which Mr. Mihle believes are more significant in indicating the efficiency of the units, particularly with regard to valve operation.

"During the performance run, the control operation is graphically recorded as a final check on the setting which had previously been done in cold pots of definite temperatures in which the controls were operated in various positions of the selector," he said.

Hook Addresses Armco Men

MIDDLETOWN, Ohio — Quincy W. Wales, of the Brown-Wales Co., Boston, was re-elected president of the American Rolling Mill Co. Distributors' Association at its eighth annual convention here, Dec. 9 and 10. Some 60 distributors attended the sessions.

A. J. Luedke, Milcor Steel Co., Milwaukee, was re-elected vice president. Bruce Haines of the Hammond Sheet Metal Co., St. Louis was elected secretary-treasurer.

Bruce Barton, author and advertising executive, was guest speaker at the banquet Dec. 9. Charles R. Hook, president of the American Rolling Mill Co., spoke on "Business Conditions As I See Them," at the opening session, and Bennett Chapple, vice president, gave the closing address, on "Marching On," in which he discussed present and future trends in the business.

Pointing out that normally 90 per cent of United States business is domestic, Mr. Hook said: "It is only from the increase in wealth to be secured from the exchange of goods and services between ourselves that we can hope to make up the major part of our financial losses incurred and to be incurred as a result of our extention of foreign credit.

"I do not minimize the serious situation brought about by the foreign financial conditions," he continued. "I do feel, however, that this foreign financial situation has become so 'ever present' in the minds of a large portion of our people that it has raised a fog so dense as to obscure the sunshine of our American domestic business which is waiting to break through."

Mr. Hook stated that for months the country has been using up goods more rapidly than it has been making them. The problem as he sees it is to increase confidence to the point where idle money will be put back on the job.

Jack Stowell, sheet metal contractor of Aurora, Ill., spoke on "The Sheet Metal Contractor's Merchandising Problems," on the morning of Dec. 10. One of the afternoon sessions was devoted to a presentation of the Plymouth motor car sales promotion program by A. H. Larson and T. L. Marshall of the Plymouth Motor Corp.

Besides the three new officers, board of director members for 1932 are as follows: Guy P. Bible of Horace T. Potts & Co., Philadelphia; A. W. Howe, J. M. & L. A. Osborn Co., Cleveland; O. J. Arnold, Arnold & Co., Baltimore.

H. B. Thompson, Conklin Tin Plate & Metal Co., Atlanta; G. L. McKewin of Farwell, Ozmun, Kirk & Co., St. Paul; F. A. Wilkening, Standard Metal Co., Pittsburgh; G. F. Ahlbrandt, the American Rolling Mill Co. The executive committee is composed of the three officers and Mr. McKewin.

HEMPHILL DIESEL STARTS REFRIGERATION TRAINING

LOS ANGELES—A night school class in domestic and industrial refrigeration has been organized by the Hemphill Diesel Engineering Schools, which teaches also courses in diesel, electrical, and marine engineering.

Refrigeration is taught by Herman Vetter in classes meeting for two hours twice a week. The night course covers a period of 15 weeks. At present 12 students are enrolled.

One night is devoted to lecture work, the other night of the work is spent in the laboratory where several makes of refrigeration equipment have been installed.

A day school course will be started on Jan. 5, Ralph Hemphill announces, to last for from six to eight weeks. Mornings will be spent in class-room work, afternoons in the laboratory, he states.

SERVICE HINTS

By FRANK W. GRAY

Some refrigeration manufacturers mount the compressors in their domestic refrigerators on springs or rubber cushions, the compressor bases being held rigid for shipment by means of bolts or long steel rods fastened to the frame of the box.

When the refrigerator is delivered to the home the service man removes these rods or bolts so that the compressor may be suspended in its flexible mounting. The rods or bolts are usually left in the bases of the cabinets, available in case the box should have to be moved or shipped again.

Such rods or bolts, or other pieces of metal such as flare caps, nails, wire, etc., should be tied securely with cord or rubber bands before being left in the base of the refrigerator, so that the normal vibration of the machine will not cause them to rattle.

This seems a small detail, but the writer knows of several instances where service calls came in simply because such loose metal parts caused an irritating rattle in the box, the users of the machine thinking that the noise was a defect in the machine itself.

One dealer in Los Angeles had so much trouble from this small source that he sent his service men to every domestic job to secure the steel rods, whether there had been a complaint or not.

It is a very wise precaution for refrigeration dealers to use a letter or form of release to be signed by the owner after the installation of a commercial or apartment house job.

This release has nothing to do with the free service guarantee, but merely states that the job has been installed in a manner satisfactory to the owner, and that workmanship and materials are acceptable to him.

The reason for this precaution is that many refrigeration buyers have been misled in their conceptions of what results to expect from a refrigeration system.

Also, it is a deplorable fact that competitive refrigeration salesmen sometimes form unethical habits of pointing out imaginary faults in systems already installed and in operation. Sometimes owners of refrigeration systems will decide, long after the free service guarantee has expired, that they are entitled to the same long period of service on commercial or apartment house systems that some companies extend on their domestic machines.

Naturally, a larger and more complicated system cannot be expected to function with the same positive certainty as a small self-contained unit. The writer knows of one instance where a lawsuit involving over $10,000 was threatened by an apartment house owner three years after a system was installed, on the grounds that the workmanship and materials were not satisfactory to him.

The owner's attorney soon saw the futility of the legal action when a copy of a release such as was mentioned above was shown him. When the threat of legal action was withdrawn, the dealer then proceeded to do what was honest and reasonable in the matter.

It is much better, however, for the decision as to adjustment in the case of dispute to rest with the refrigeration dealer, who knows what normal refrigeration operation should consist of, than that the decision should be submitted to a jury whose knowledge is that of the layman.

The use of such a release would also help materially in the collection of bills for service work, which some refrigeration owners neglect to pay long after the period of free service has expired.

CANDY COMPANY BUYS YORK COOLING UNITS

LOS ANGELES—A $3,000 air conditioning system has been installed by the York Ice Machinery Corp., Los Angeles, in the chocolate dipping room of the $200,000 modernized See Candy-making unit, here.

Insulated with a half-inch blanket of Celotex on the inside surface and sawdust between the studs, this special room with windows of double glass, and approximately 24x48x10 ft. in dimensions, is equipped with a York air conditioner of dry coil unit type. Cooled air is distributed by means of cowls and a fan.

A temperature of 65° F. is maintained automatically by means of thermostat control which starts and stops the machine.

BONEBERG TELLS STATUS OF SERVICE MEN'S GROUP

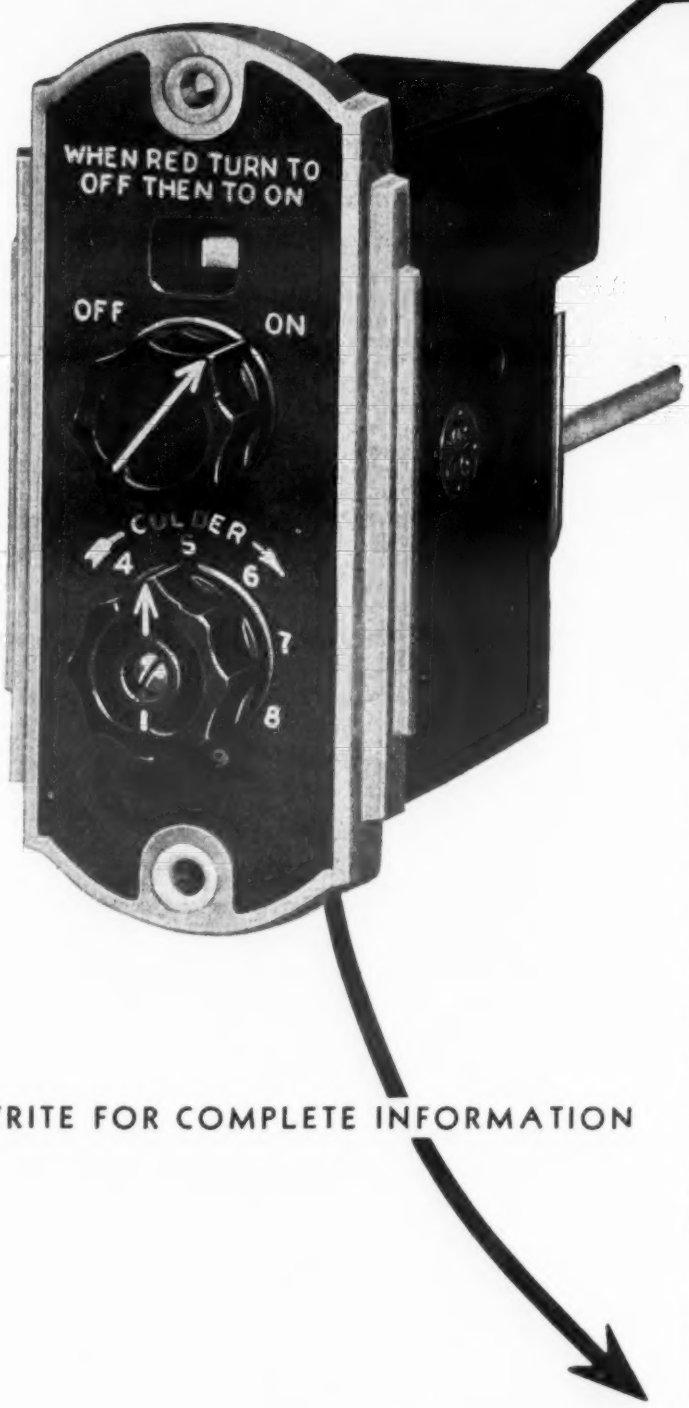
BUFFALO, N. Y.—Membership in the sole chapter (Buffalo) of the National Society of Refrigeration Service Engineers numbers 25, with 10 applicants from outside the city, states Milton Boneberg, founder of the society, in a report on its present status.

Cash received in the national treasury, including dues and initiation fees, amounts to $104. The total expended to date is $168.50.

Ninety-three requests for information on the organization have been received at the executive office since the founding of the society, the report states.

The society is now a corporation, and maintains two offices: the executive office in Buffalo, and an office in Delaware. Plans for sending out educational material to members of the society have not yet been carried through, according to Mr. Boneberg.

HERE IT IS!



ELECTRIC REFRIGERATOR CONTROL by GENERAL ELECTRIC

A NEW CONTROL UNIT—PROVIDES accurate temperature control; complete overload protection. A product of the highest quality based on years of experience.

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Company .....
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ENGINEERING SECTION ELECTRIC REFRIGERATION NEWS

The Business Newspaper of the Refrigeration Industry

ELECTRIC REFRIGERATION NEWS is published *every week*.
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Editorial Aims of the News

To encourage the development of the art.

To promote ethical practices in the business.

To foster friendly relations throughout the industry.

To provide a clearing house for new methods and ideas.

To broadcast the technical, commercial and personal news of the field.

Another Significant Step

REPORTS in this issue of the first installations of air conditioning equipment on American steamships are substantial evidence of the foresight of industrial prophets who have predicted more widespread use of air conditioning and who have hailed this application of refrigeration as a development which will help the return of business prosperity.

Men who are engineering the ship installations point out that air conditioning is a logical development in travel comfort. Examination of other applications of air conditioning indicate that they were all logical—process industries, theatres, office buildings, Pullman cars, restaurants, etc.—all accomplished where particular situations indicated that air conditioning was *commercially desirable* and *economically practical*.

Commercially Desirable

In process industries, it was commercially desirable to improve the products of manufacture by correcting adverse climatic conditions, and economically practical because the spaces to be conditioned were not so great but what the cost of air conditioning could be justified by its advantages.

It is commercially desirable to attract people to theatres, public auditoriums, Pullman cars, and restaurants because increased attendance means increased revenues to the operators, and any instrument which encourages people to attend is regarded as commercially desirable since its results are reflected in dollars and cents.

Economically Practical

With respect to economic practicabilities, it is interesting to note that many were made for densely populated spaces, in buildings with comparatively good heat insulation. Also, the spaces conditioned were fairly large, and unbroken by numerous partitions which would make air circulation and temperature control more difficult.

In these installations the air could be cleaned, cooled, and humidities and temperatures controlled by a central machine, and circulated through the confined space at a cost that was within reason.

The extension of air conditioning to the dining rooms of steamships is a step along the same line of reasoning. The clientele is well-paying and appreciative of comfortable conditions, the conditioned space is limited in a dining room, and ship construction is not excessively wasteful of heat.

Further progress in new applications of air conditioning is expected. Perhaps it will be in high-priced apartment buildings where commercial desirability and economic practicability will work to that end. For here again are fastidious customers living in compact spaces of well-built structures, and they may be willing to pay the cost of the additional comfort.

Beyond the Power Lines

OUT where the power lines do not reach are many places where mechanical refrigeration is as necessary for food preservation as it is in the metropolitan housewife's kitchen and in the butcher's meat case.

Conducive to the adoption of mechanical refrigeration by the farmers are recently passed state legislative bills requiring that all milk for commercial markets be cooled promptly after it is produced.

Distributors of commercial electric refrigerators have become aware of this potential rural market, and have induced their manufacturers to supply them with refrigerating machines equipped with gasoline engines for motive power.

Engine manufacturers have sensed the opportunities afforded by the field for non-electric refrigeration, and have developed compact, air-cooled machines with control devices which start and stop the gas engine automatically according to dictates of the temperatures in the refrigerated chamber.

Operating and maintaining a gasoline engine is no trick to the average farmer because he has usually developed his own skill to drive the various-sized gas engines often employed to relieve the burden of farm labor. Hence the gas engine powered refrigerating plant presents no major problem to the farmer.

The result is that refrigerator manufacturers report a pleasing volume of business of this type, engine builders find a new market for their machines, and consumers are supplied with better preserved farm products.

GLEANINGS
FROM RECENT PERIODICALS

RANGES TO FOLLOW TRAIL BROKEN BY REFRIGERATORS

ELECTRIC ranges are to have their day of real, "honest-to heaven" commercial exploitation on a national scale. This seems assured as efforts of manufacturers and utilities, through their respective associations, shape themselves toward definite action. The recent approval of the project by the range committee, Commercial National Section, N.E.L.A., places it on a footing of acceptance in principle, and all that apparently remains now is to work out the details of the campaign and get it started. The electric range is at last to be treated on the comprehensive commercial scale that should have been employed a long time ago in dealing with it.

The success of the refrigerator campaign has convinced many who before were doubters that the sale of a meritorious article can be tremendously increased by intelligent and extensive advertising and planned sales activity. There is a "but," however. It lies in the fact that the range disputes its field against much more effective competition than does the electric refrigerator and also that its competitors are much more largely controlled by the same individuals or companies who operate the electric utilities than is the ice industry.

Moreover, a great many more central stations throughout the country should have rates that will permit the operation of electric ranges.

Obstacles to the widespread sale and use of electric ranges are minor ones, however. There is an existing market in which both rate conditions and competitive conditions are conducive to their sale on a very large scale.

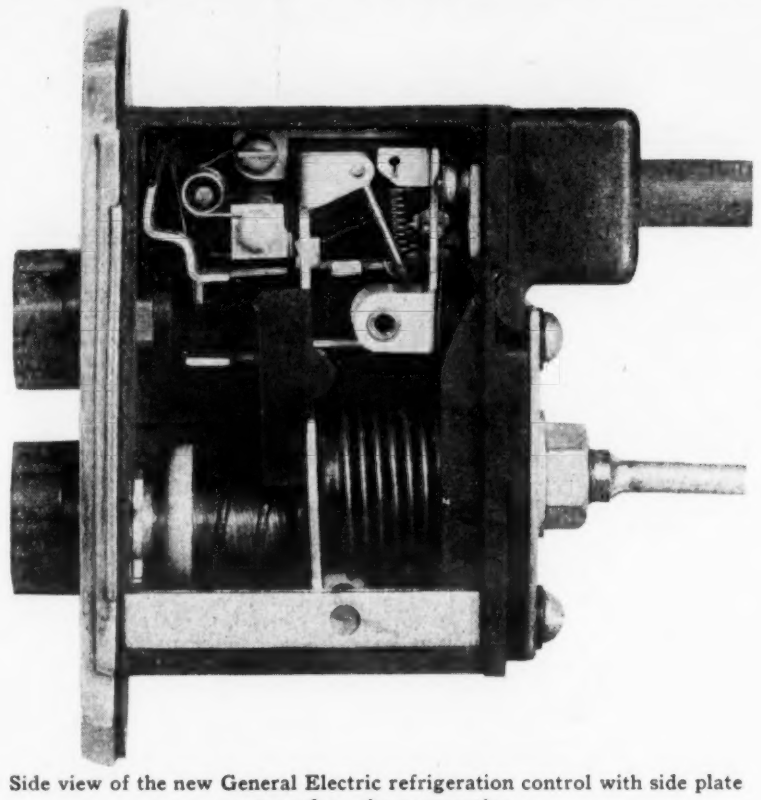
A well-organized national effort with a distribution organization adequate to "follow through" the advertising program will get results.—*Electrical World*, Dec. 5, 1931.

MAKE USE OF THE TECHNICAL MAN

NOW as never before industry has the opportunity to use the brains of technically trained men and to profit by such use. A case in point: A process industry in the Chicago district several months ago found that it had no work for 20 young engineers on its staff. They were the newcomers, logically the first to be laid off. But instead of turning them loose the chief engineer called them into his office and put a sporting proposition before them. He said: "The 20 of you are costing the company $4,000 a month. There is no work now or immediately in sight for you. Rather than give you each a month's notice to hunt for new jobs that probably you won't find, I am going to give you a two months' chance to see what you can do right here. Go out into the plant and check up everything in sight. See if you can't stop wastes or change methods so as to save the $4,000 a month the company is paying you."

The 20 went through that plant with the thoroughness of grasshoppers in a wheat field. They found many things whose correction in sum total of economy equaled their salaries. In addition, and of spectacular significance, they discovered a means to reduce the use of process steam from eight to three pounds per unit of product at a saving of $25,000 per month.—*Electrical World*, Dec. 12, 1931.

General Electric Refrigeration Control



Side view of the new General Electric refrigeration control with side plate removed to show operation.

CONTROL DEVELOPED BY GENERAL ELECTRIC

(*Concluded from Page 1, Column 2*)

the line, is actuated by the expansion and contraction of the bellows, caused by the pressure changes resulting from temperature variations of the tube end.

A bellows compression spring is used, the pressure of which is varied by the temperature adjustment knob.

By turning this knob in the "colder" direction, the spring pressure is decreased so that the temperature of the evaporator plate is brought to a lower point before the bellows will contract enough to operate the switch mechanism, disconnecting the motor from the line.

When there is a sustained overload on the motor, a solder-film overload device trips, opening the switch and disconnecting the motor from the line. A red flag appears at the small aperture in the front of the unit, providing visible indication that the compressor motor has been disconnected from the line because of an overload.

The refrigerator will remain inoperative until the overload device has been reset manually by turning the "off-on" knob first to the "off" and then to the "on" position, it is explained. If the device has not had sufficient time to cool, it will not reset and, as soon as the knob is returned to the "on" position, it will trip and the red flag will reappear.

It is impossible to burn the motor out by applying power to it, when the overload device is being reset, since the switch is locked open when the knob is in the "off" position, General Electric engineers claim.

The temperature of the food chamber is varied by adjusting the temperature control knob anywhere between the positions 1 and 9 (indicated by numerals surrounding the knob). The screw holding the temperature adjustment knob is sealed in.

When it is desired to defrost the refrigerator, the "off-on" knob is turned to the "off" position, locking the switch open.

Sulphur dioxide is used in the bellows where the range temperature requirements are above 10° F. Methyl chloride is used where the range temperature requirements are below 10° F.

FILTRINE-SERVEL COOLERS INSTALLED IN PIERS

NEW YORK CITY—The New Piers on North River, now occupied by the United Fruit Co.'s general offices, has just been equipped with Filtrine-Servel cabinet type water coolers.

Seven self-contained water coolers were installed in the office space, which consists of a building three stories high, 350 ft. long, by 60 ft. wide. Each cooler is equipped with faucet and bubbler, and each supplies water to Halsey Taylor fountains on floors above and below.

Filtrine model 1-E-1 and Servel model 30-AW machines with Filtrine No. 4 filters were used throughout.

NEW COILS FOR YACHT

MIAMI, Fla.—The Domestic Refrigeration Co., Inc., is installing several separate coils in the built-in boxes now in use in the Yacht Buccaneer. The owner wired the company to have the equipment installed so that the yacht would be in readiness when he arrived from New York.

Letters from Readers

Suggests Directory of Refrigerating Engineers

Theo. H. Davies & Co., Ltd.
Honolulu, T. H.
Nov. 12, 1931.

Editor:

The writer has been a loyal reader of your publication for the past two years. It is most comprehensive in its scope and covers the field very thoroughly.

With the issue of the 1932 REFRIGERATION DIRECTORY near at hand, I am awaiting my copy with keen anticipation. Judging by the preliminary listings noted in the current issue of the NEWS, this promises to be an exceedingly worth while publication.

For some time I have had the idea that another type of directory would find ready acceptance in the refrigeration field; namely, a directory embracing the names, addresses and positions of all the engineers, installation men and service men connected with this fast growing industry. I feel that I voice the sentiment of a good many others when I state that it would be a source of interest to the men scattered all over the world to be able to look up old friends and associates through this medium. Then, too, the value of a directory of this nature would be very practicable in that it would serve as a guide in determining the approximate number of men employed, thereby ascertaining the increase or growth from year to year.

J. W. RUBENSON,
Engineer.

Service Business Reported Good

George F. Allen.
Springfield, Mass.
Nov. 11, 1931.

Editor:

The NEWS has always been very interesting to me, and especially so since I entered the refrigeration service business for myself in February of this year.

I have had no trouble getting all the service and installation work I can do, and have plenty in sight right now—which is supposed to be the dullest time of the year.

We find that competent service is much needed in the field, and that satisfied users mean more sales. I am confident that everything your paper does to aid the independent service man is bound to help the whole industry.

GEORGE F. ALLEN.

Furnishes Service 24 Hours a Day

Martin's Refrigeration Service.
Fresno, Calif.
Nov. 10, 1931.

Editor:

The NEWS has been a great help to me since I started in the independent service business two years ago. I started with 25 customers, now have more than 1,000 regulars, and more coming steadily. We are equipped to render fast, efficient service, 24 hours a day, seven days a week, at a minimum overhead expense which results in savings to the customer.

E. E. MARTIN.

Kinetic Chemicals Report on Tests of Refrigerants

Tests to Show Toxic, Irritant, and Fire Characteristics of Certain Well Known Refrigerants

Directed by W. S. Calcott, director—Jackson Laboratory, E. I. du Pont de Nemours and Co., Inc., assisted by Dr. Robert A. Kehoe, Kettering Laboratory of Applied Physiology, University of Cincinnati, Ohio, on Oct. 28 and 29, 1931, at Deepwater Point, N. J., for Kinetic Chemicals, Inc., Wilmington, Delaware.

Tests by: W. S. Calcott, director, and staff of Jackson Laboratory, assisted by Dr. Robert A. Kehoe and staff.

Test data compiled by: A. F. Benning and R. C. McHarness.

Report by: A. F. Benning, F. B. Downing, R. C. McHarness, G. H. Miller, H L. Miner, and C. D. Porch.

Reviewed by: W S. Calcott, director, Jackson Laboratory, E. I. du Pont de Nemours and Co., Inc. Dr. Robert A. Kehoe, Kettering Laboratory of Applied Physiology, University of Cincinnati, O.

Note: All requests for additional information or questions and comments on this report should be addressed to Kinetic Chemicals, Inc., Wilmington, Delaware.

INTRODUCTION

The following tests were carried out at Deepwater Point, N, J., to show the comparative toxic, irritant, and fire characteristics of certain well-known refrigerants.

The necessity for conducting these tests was due to the fact that while certain characteristics of Kinetic No. 12 (dichlorodifluoromethane, also known as F-12), had been given considerable publicity, similar information with reference to commonly used refrigerants was not available as a basis for comparison. Therefore, Kinetic Chemicals, Inc., arranged for the Jackson Laboratory of E. I. du Pont de Nemours and Co., Inc., in conjunction with Dr. Robert A. Kehoe, Kettering Laboratory of Applied Physiology, University of Cincinnati, to conduct these tests at Deepwater Point, N. J., on Wednesday, Oct. 28, and Thursday, Oct. 29, 1931. A detailed study of the refrigerants which were tested and also certain other chemicals which are or may be used for refrigeration, is now being made by the Underwriters' Laboratories, Inc., Chicago, Ill.

The widespread use of household refrigerating machines may introduce a health or fire hazard, or both, arising from the possible leakage of the refrigerant. The hazard will vary considerably with the size of the leak and the refrigerant used. It is obvious that any of the commonly used refrigerants can be employed with safety provided the enclosing equipment remains intact preventing its escape. However, any mechanical assembly is subject to failure therefore, the safer the refrigerant employed, the less is the hazard involved.

When judging the possible hazard to life and property which may be introduced by the escape of a refrigerant, the following factors must be considered:

Properties to be Studied

First: What effect will the refrigerant itself have on human life, i. e.

(a) Is it toxic?

(b) Is it irritating?

(c) If toxic, is its action immediate or delayed?

(d) If toxic, does it give sufficient warning of its presence?

Second: Will the refrigerant or its vapor introduce fire or explosion hazards?

Third: Will its physical properties, such as vapor density, rate of evaporation or diffusion, increase the hazard?

Inasmuch as these characteristics are not influenced by any extraneous conditions, they are judged to be of prime importance.

Finally, after the above factors have been determined, consideration should be given to those contingencies which may aggravate existing hazards or even introduce new ones. As applied to the use of refrigerants in ordinary occupancies, these hazards narrow down to the possible formation of products of combustion or gases of decomposition brought about by the subjection of the refrigerant to the action of a high temperature; for instance, by bringing into contact with a flame.

It was with all of these questions in mind that the following tests were made.

Factors affecting the economic use of refrigerants, such as physical and chemical properties, have reduced the materials in general use to a relatively small number. The following refrigerants were selected as representing those most widely used:

Sulfur dioxide.
Dichlorodifluoromethane (Kinetic No. 12).
Methylene chloride.
Methyl chloride.
Carbon tetrachloride.
Carbon dioxide.
Ammonia.
Propane.
Isobutane.

Carbon tetrachloride was included for comparative purposes because of its chemical similarity to some of the refrigerants, because of its extensive use for many years as a fire extinguishing agent, and because it is considered relatively harmless.

Physical and Chemical Data

Sulfur dioxide (SO_2):

Sulfur dioxide is a gas which condenses to a liquid at 14° F. at atmospheric pressure. The specific volume at 70° F. is 6.7 cu. ft. per pound, and the liquid density at the boiling point is 1.46. It is an acid anhydride fairly soluble in water. The dry gas is noncorrosive, but in the presence of water, sulfurous acid is formed which will corrode most of the common metals. It is non-flammable.

Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2):

Kinetic No. 12 is a gas, condensing at -21.6° F. at atmospheric pressure. The specific volume at 70° F. is 3.33 cu. ft. per pound. The density of the liquid at the boiling point is 1.48. Kinetic No. 12 is an inert gas at ordinary temperatures and does not corrode any of the common metals. It is only slightly soluble in water. It is non-flammable.

Methylene chloride (CH_2Cl_2):

Methylene chloride is a liquid boiling at 104.2° F. at atmospheric pressure. The density of the liquid is 1.34. It is non-flammable below its boiling point and is stable at ordinary temperatures. No reliable information of its corrosive properties was found.

Methyl chloride (CH_3Cl):

Methyl chloride is a gas, condensing to a liquid at -11.4° F. at atmospheric pressure. The specific volume is 7.5 cu. ft. per pound at 70° F., and the density of the liquid at the boiling point is 0.998. It is moderately flammable, and the vapors in admixture with air at concentrations of 8.1 to 17.2 volume per cent are explosive.

Carbon tetrachloride (CCl_4):

Carbon tetrachloride is a liquid boiling at 170.2° F. at atmospheric pressure. The density of the liquid is 1.59. Carbon tetrachloride is non-flammable, and only slightly soluble in water.

Carbon dioxide (CO_2):

Carbon dioxide is a gas which condenses to a solid at -109.3° F. at atmospheric pressure. The solid melts under pressure at -69.9° F. The specific volume is 9.9 cu. ft. per pound at 70° F. Carbon dioxide is soluble in water, but its solutions are only weakly acidic. It is non-flammable.

Ammonia (NH_3):

Ammonia is a gas condensing to a liquid at -28° F. at atmospheric pressure. The specific volume at 70° F. is 25.4 cu. ft. per pound, and the liquid density at the boiling point is 0.68. Ammonia is stable at ordinary temperatures and when dry is non-corrosive. It is very soluble in water, and its solutions are strongly alkaline. Ammonia will burn and in admixture with air at concentrations between 16.0 and 25.5 per cent by volume, is explosive.

Propane (C_3H_8):

Propane is a gas which condenses to a liquid at -48.1° F. at atmospheric pressure. The specific volume is 9.7 cu. ft. per pound at 70° F. The liquid density is 0.585 at the boiling point. Propane is non-corrosive, and only slightly soluble in water. The vapors are flammable in low concentrations or percentages in air. The explosive limits with air are 2.4 and 8.4 volume per cent.

Isobutane (C_4H_{10}):

Isobutane boils at 8.1° F. at atmospheric pressure. The vapor volume at 70° F. is 7.3 cu. ft. per pound. Like propane, isobutane is flammable. The explosive limits with air are 1.80 and 8.45 volume per cent. Note: See Table No. I for summary.

OUTLINE OF TESTS

The tests were arranged in four series.

Series No. 1:

These tests were run to show the toxic, irritant, and flammable characteristics of the refrigerants assuming the escape of a large amount into an unventilated 1,000 cu. ft. room. Each test consisted of two parts: first, 10 pounds* of the refrigerant were admitted into the test building during a short period of time, and the behavior of the animals was carefully observed for 15 minutes; second, two standard gas burners in the test building were lighted and allowed to burn for 30 minutes or until definite conclusions had been reached. These tests were intended merely for purposes of comparison, and the probability of similar conditions ever arising is exceedingly remote. Conditions were selected to promote vigorous effects which would show definite results within a short period, and every effort was made to maintain uniformity during the tests so as to obtain data of unquestionable accuracy. These tests were carried out on Wednesday, Oct. 28, 1931.

Series No. 2:

These tests were similar to those of Series No. 1 except that 3½ pounds of refrigerant was used in each test instead of 10 pounds, and the gas was lighted immediately after the discharge of the refrigerant into the building. These tests were performed on Thursday morning, Oct. 29, 1931.

Series No. 3:

This series was designed to supplement the information developed in Part 1 of Series No. 1. It consisted of exposing animals in small enclosures to an atmosphere containing various concentrations of the refrigerants in the absence of a gas flame, in order that the effect of the refrigerants themselves might be noted. Because of the time factor, these tests could not be run in the test building, the series extending over both days.

Series No. 4:

In order to give those present an opportunity to suggest additional tests which they might wish to have made, a committee was appointed consisting of Mr. A. H. Nuckolls, chemical engineer, Underwriters' Laboratories, Inc., Chicago, chairman; Mr. Harry D. Edwards, consulting engineer, Union Carbide and Carbon Corp.; Mr. C. K. Michaels, engineering department, Bureau of Fire Prevention of New York; Mr. W. B. White, superintendent, New York Board of Fire Underwriters; and Dr. William P. Yant, superintendent, United States Bureau of Mines, Pittsburgh. This committee was given authority to have additional tests carried out and accordingly arranged the program for the second afternoon.

Test Equipment:

Series Nos. 1, 2 and 4 were conducted in a test building of 1,000 cu. ft. capacity. The building was 10 ft. by 10 ft. by 10 ft. in size, constructed of wood with floor, ceiling, and two sides lined with galvanized sheet iron with seams sealed with "Pecora" cement. Each of the other two walls was composed of three wooden frames, each 3 ft. by 10 ft., covered with moisture proof Cellophane, 0.001 in. in thickness. The interior of the building was painted with a flat white lithopone paint. A pipe railing was placed around the building to facilitate replacement of frames.

To permit observation of the gas

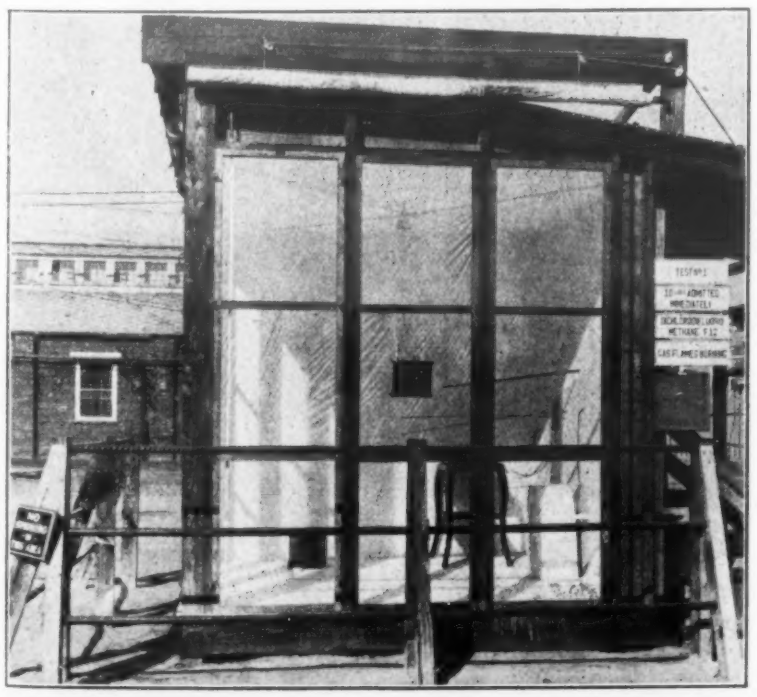
(Continued on Page 6, Column 1)

*Pound basis of comparison was adopted as being the basis used in all code work.

Table No. 1—Summary of Physical and Chemical Data

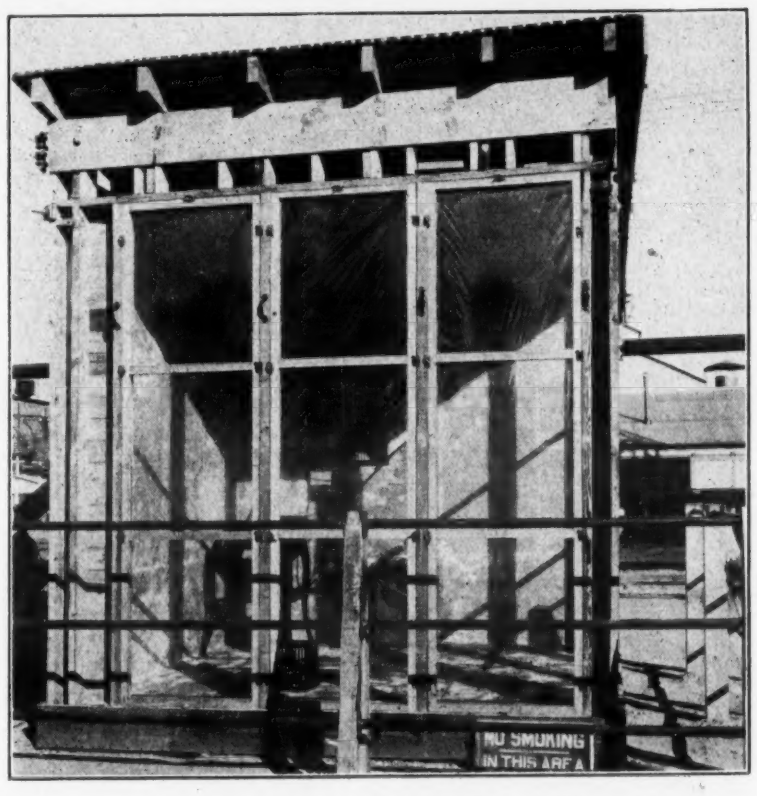
	Chemical Formula	Boiling Point °F.	Specific Vol. cu. ft./lb.	Liquid Density at b.p.	Flammable	Explosive Limits Volume %
Sulfur dioxide	SO_2	14	6.7	1.46	No	Not Explosive
Dichlorodifluoromethane (Kinetic No. 12)	CCl_2F_2	- 21.6	3.3	1.48	No	Not Explosive
Methylene chloride	CH_2Cl_2	104.2		1.34	No	Not Explosive
Methyl chloride	CH_3Cl	- 11.4	7.5	0.998	Yes	8.1 17.2
Carbon tetrachloride	CCl_4	170.2		1.59	No	Not Explosive
Carbon dioxide	CO_2	-109.3	9.9		No	Not Explosive
Ammonia	NH_3	- 28	25.4	0.68	Yes	16.0 25.5
Propane	C_3H_8	- 48.1	9.7	0.585	Yes	2.4 8.4
Isobutane	C_4H_{10}	8.1	7.3		Yes	1.8 8.45

'Wrapped in Cellophane'



Photograph No. 1—South side of test building showing location of gas stove, fan enclosure, sampling tubes, and animal cages. The side of the building is constructed of removable frames covered with Cellophane.

The Scene of Action



Photograph No. 2—West side of test building, constructed of wooden frames covered with Cellophane. Inside appear cages, gas stove, and fan.

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Results of Laboratory Tests on Refrigerants

Test Procedures Are Described For Each Series

(Continued from Page 5, Column 5)

flame, a window of bullet proof safety glass was installed in the east wall above the control equipment bench close to the gas burners.

The building was equipped with a two-burner gas stove located in one corner. The gas fed to the stove was measured by a dry meter, and a flow meter was also provided to permit maintaining the desired rate of flow. The gas was ignited from the outside by means of a pair of spark plugs.

A refrigerator fan, 7⅞ in. in diameter, driven by an outside direct connected motor running at 1740 r.p.m., was installed near the floor at the center of the east wall. This fan gives a velocity of 1,000 linear ft. per minute at a point 3 in. in front of the fan, as installed in photograph No. 3, and a velocity of about 468 linear ft. per minute as measured ½-in. in front of a condenser.

The inlet tube for the introduction of the refrigerants was run through the east wall and discharged directly into the fan.

The animal cages were located as follows: one on the floor at the corner opposite the gas stove; the other suspended from the center of the ceiling with the bottom of the cage 5 ft. above the floor. Two thinly wax-coated copper sampling tubes extended from the center of the building to analytical equipment located outside on the east wall. (See photograph No. 3.)

All control apparatus was located on the outside of the east wall which was of solid construction. A scale was provided to weigh the amount of gaseous refrigerant admitted to the building, while two liquids were measured in a glass cylinder. Apparatus was also installed for withdrawing gas samples from the building, for absorbing the acid vapors and measuring the volume of the samples taken. (See photographs Nos. 4 and 5 for details.)

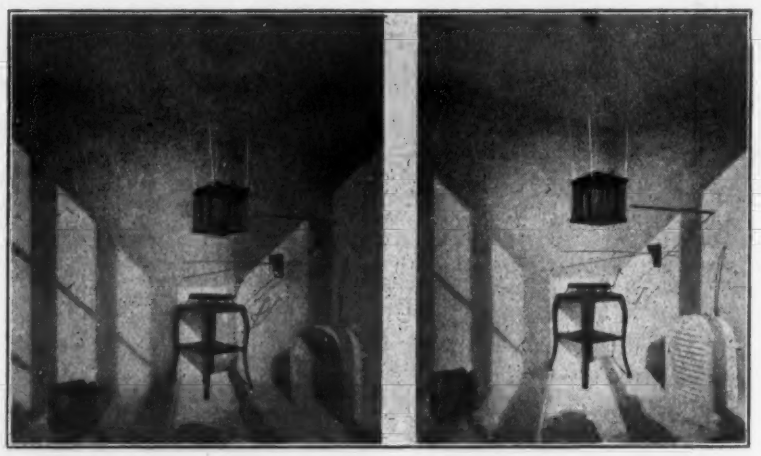
Test Materials:

The refrigerants used in these tests were purchased directly from the manufacturers and were their standard refrigeration grade.

The test animals were full grown guinea pigs selected from the biological experimental stock of the University of Cincinnati.

The gas burned in the stove was a 20% butane air mixture, the calculated heating value of the mixture being from 670 to 700 b.t.u. per cu. ft.

Interior of Test Room



Photograph No. 3—Interior of test building. Left view shows location of gas stove, animal cages, gas sampling tubes, and thermometers as used in Test Series No. I. At right appears arrangement for Tests No. 2 and 4.

DECOMPOSITION PRODUCTS OF TESTED REFRIGERANTS

Sulfur dioxide (SO_2):

Sulfur dioxide does not decompose below 2000° F. but oxidizes slowly in the presence of moisture.

Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2):

Kinetic No. 12 is thermally stable up to 1000° F. It is non-flammable but, when brought into contact with a flame, that portion which is simultaneously heated to the high temperature and exposed to the action of water vapor and oxygen, is decomposed with the formation of CHl, HF, CO_2, and under certain conditions, traces of $COCl_2$.

Methylene chloride (CH_2Cl_2):

No data are available on the thermal decomposition of this refrigerant. Under the conditions given for the flame decomposition of Kinetic No. 12, it decomposes to give HCl, CO_2, and some $COCl_2$.

Methyl chloride (CH_3Cl):

Methyl chloride, when heated, begins to decompose noticeably at 500° F. It is flammable and when burned produces water, CO_2, and HCl, but no $COCl_2$.

Carbon tetrachloride (CCl_4):

Carbon tetrachloride begins to decompose at 900° F. In the presence of a flame, it is partly converted to HCl, CO_2, and some $COCl_2$.

Carbon dioxide (CO_2):

Carbon dioxide will not decompose noticeably below 2000° F. It is non-combustible.

Ammonia (NH_3):

Ammonia, when heated alone, begins to decompose into nitrogen and hydrogen at 500° F. In the presence of air, it can be burned to water and nitrogen.

Propane (C_3H_8):

Propane is thermally stable below 500° F. When ignited, it burns readily, giving CO_2 and water vapor.

Isobutane (C_4H_{10}):

Isobutane is thermally stable below 500° F. It is flammable and will give CO_2 and water vapor when burned.

Burner Gas for Gas Stove:

The burner gas, containing 20% butane, will, upon burning, give CO_2 and water vapor.

General Procedure

The amount of each of the gaseous refrigerants discharged into the test building was determined by weight; both liquid materials were measured in a graduate glass cylinder.

The burner gas was measured by a standard type integrating gas meter. The rate of flow, which was kept at 20 cu. ft per hour, was indicated by a manometer placed in the gas line.

Temperatures were taken with suitable thermometers which had been calibrated shortly before the tests.

The condition of the animals during the tests was checked by observation. All animals that died were kept on ice and examined at the end of the day on which the test was performed. The animals that survived until after the completion of the test program were sent to Dr. Kehoe in Cincinnati.

The blood of the animals that died during the flame tests was tested for carbon monoxide by the Pyrotannic acid blood test described in the Bureau of Mines Technical Paper No. 373. Data on the pathological condition of each animal after the tests are outlined in Appendix "A" on page 9 of this report.

The total acid concentration in the test building was determined by absorption in standard alkali using the highly efficient perforated platinum distributor recommended in the Bureau of Standards, Journal of Research (Vol. 6—Page 132—1931). Phenolphthalein was used as the indicator. The volume of gas required to neutralize the alkali was measured with a wet test meter.

Hydrochloric and hydrofluoric acids were determined in the neutralized solution from the total acid analyses. The chlorine ion was estimated by titration with silver nitrate solution and fluorine ion by the titanium dioxide colorimetric method. Carbon dioxide was determined by difference.

Tests for phosgene were made by drawing a separate sample of gas from the test building and passing it through an aqueous solution of aniline. Phosgene, if present, reacts with the aniline to form diphenylurea, which precipitates. Any precipitate formed was identified by its melting point. (See Compt. Rend. 168, 773 (1919)).

Tests for carbon monoxide were made on a separate sample taken at the time of the test. The carbon monoxide present was estimated by oxidizing it to carbon dioxide with iodine pentoxide, the liberated iodine being distilled into potassium iodide solution and titrated with a standard thiosulfate solution. This method is described in Industrial and Engineering Chemistry (Anal., Edition, Vol. I, page 129 (1929)).

SERIES I TESTS

These tests were performed on Oct. 28, 1931.

The tests of this series consisted of introducing 10 pounds of the refrigerant into the test building. Unless otherwise noted, each cage in the tests contained one full grown guinea pig. The refrigerant was allowed to circulate in the test building for 15 minutes (Part I of the test), after which time the gas burners were lighted and the gas rate adjusted to 20 cu. ft. per hour (Part II of the test). If the pigs survived through Part I, the gas burners were lighted and allowed to burn for a maximum of 30 minutes. If the pigs died before the end of the 30-minute period, the specific test was considered ended. During the test, a record was kept of the temperatures at the two cages. Air samples were withdrawn for analysis at suitable intervals during the time the gas was burning. Newly covered frames were used for each test; and between tests, the Cellophane covered frames were removed to permit thorough airing of the test building.

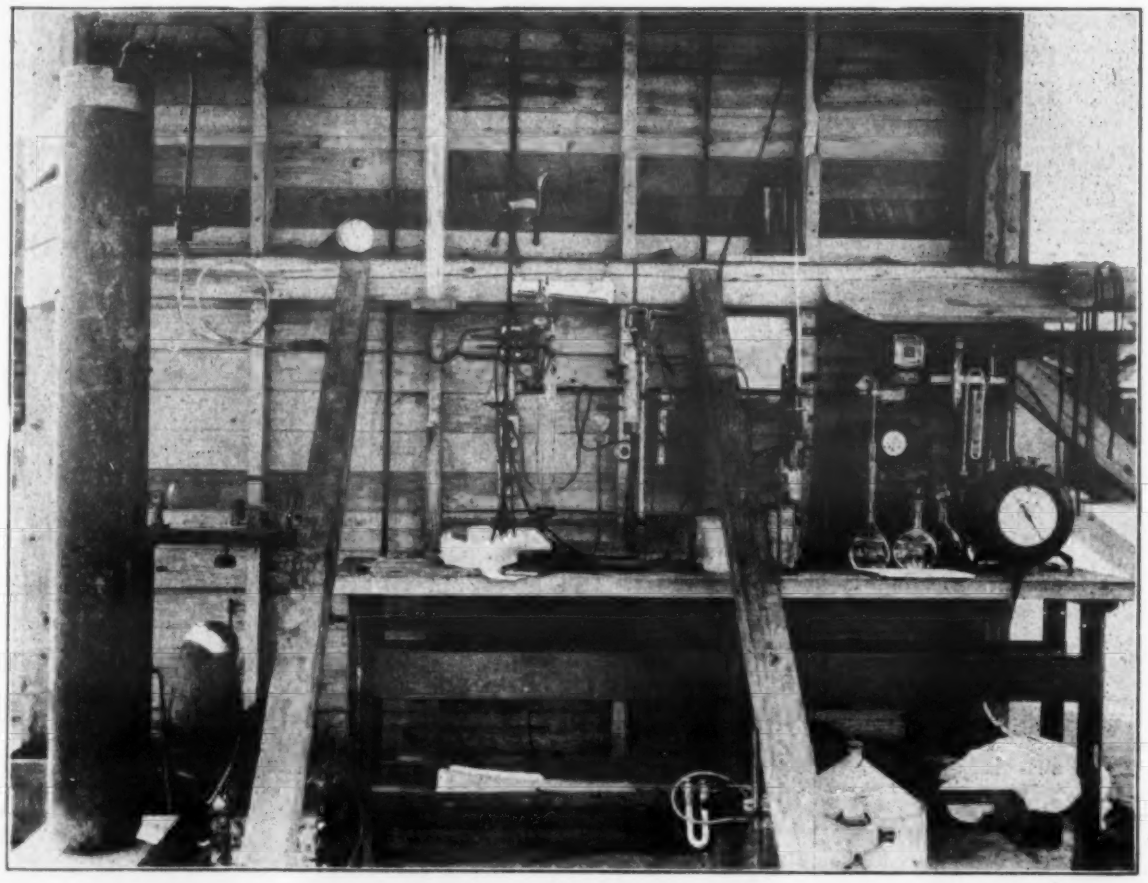
On the day these tests were run, no acid analyses were obtained due to failure of the absorbing apparatus. Data are, however, available from identical tests performed previous to the above date which tests are strictly comparable with those run during the program of the 28th. The data so obtained are enclosed in parentheses and are in italics for identification.

The time from the start of each test to the death of each animal was recorded. Autopsies were performed in all cases, and the findings are reported in Appendix "A." (See page 9.)

Measuring Refrigerant

Photograph No. 4—East side of test building showing (lower left) scale for weighing refrigerant discharged into room, and glass cylinder (top) for measuring methylene chloride and carbon tetrachloride used in tests. Control apparatus appears behind scales.

Control Apparatus



Photograph No. 5—General view of east side of building. On the bench appears apparatus for controlling and recording gas consumption, and for determining the character of the gases of decomposition, etc. Above the brace in the center of the picture is the scale of the thermometer which registers inside temperatures. The refrigerant cylinder and scales for weighing the refrigerant used in a test appear on the left.

Test 1—Sulfur dioxide (SO_2):
Part I

Ten pounds of sulfur dioxide was introduced in 7 minutes. The temperatures at the start were 64° F. at the upper cage and 62° F. at the lower cage. Both animals showed signs of distress shortly after beginning the introduction of the gas. The lower animal died 6 minutes after the start of the test (the start of the gas flow), and the upper animal 8 minutes after the start.

As both pigs died and SO_2 is non-combustible, Part II was not run.

Test 2—Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2):
Part I

Ten pounds of Kinetic No. 12 was introduced into the test building in 2 minutes. The temperature at the start was 64° F. at both cages. After exposure for 15 minutes, the animals showed no symptoms of being affected by the refrigerant. The gas was then lighted.

Part II

The upper animal died 41 minutes after the start of the test, or 24 minutes after the gas was lighted. The lower animal died 3 minutes after the upper one.

Acid analyses on a previous run showed the presence of *(0.07)*% halogen acids and *(0.18)*% CO_2 15 minutes after lighting the gas and *(0.18)*% halogen acids with *(0.39)*% CO_2 30 minutes after the gas was lighted. Carbon monoxide, 28 minutes after the gas was lighted, was present to the extent of 0.02%. Qualitative tests showed the presence of traces of phosgene in a sample taken 22 minutes after the gas was lighted. (For detailed information on phosgene as a decomposition product of Kinetic No. 12, see Underwriters' Laboratories' Report of Dichlorodifluoromethane—Kinetic No. 12—Miscellaneous Hazard 2256—dated Oct. 10, 1931—Appendix "B.") At the end of the test, the temperatures were 89° F. upper and 84° F. lower.

Test 3—Methylene chloride (CH_2Cl_2):
Part I

Ten pounds of methylene chloride was introduced into the test building through a ¼-in. copper tube terminating directly above the fan. The liquid was admitted in 3 minutes. The initial temperatures were 79° F. at the upper cage and 68° F. at the lower cage. Upper pig became unconscious in 3½ minutes; the lower pig, in 9 minutes after starting the admission of the refrigerant.

PART II

The gas was lighted 20 minutes after the start of the test. Acid analyses on a previous run showed the presence of *(0.11)*% *CHl and (0.07)*% CO_2 15 minutes after lighting the gas; *(0.30)*% CHl and *(0.09)*% CO_2 30 minutes after the gas was lighted. Carbon monoxide, 22 minutes after the gas was lighted, was 0.06%. Qualitative tests showed the presence of phosgene in the sample 17 minutes after lighting the gas.

The upper animal died 29 minutes after the start, which was 9 minutes after the gas was lighted. The lower animal died 45 minutes after the start or 25 minutes after the gas was lighted.

The temperatures at the end of the test were 118° F. at the upper cage and 100° F. at the lower cage.

(Continued on Page 7, Column 1)

Summaries of Comparative Refrigerant Tests

Table No. 2—Summary of Series I Tests

Ten lbs. of refrigerant in 1,000 cu. ft. test building. Flame lighted 15 minutes after introduction of refrigerant. Gas rate 20 cu. ft. per hr. Two animals in building during test.

Test	Refrigerant	Symbol	Time to Introduce Minutes	Temperature at Cages: Start Upper °F	Start Lower °F	Finish Upper °F	Finish Lower °F	Analyses: 15 min. after gas lighted Total Halogen Acids %	15 min. CO₂ %	30 min. after gas lighted Total Halogen Acids %	30 min. CO₂ %	COCl₂* %	CO %	Exposure and Fate of Animals: Before gas lighted Upper Min.	Upper Fate	Lower Min.	Lower Fate	After gas lighted Upper Min.	Upper Fate	Lower Min.	Lower Fate	Length of test Minutes	After effect on Animals
1	Sulfur dioxide	(SO_2)	7	64	62	64	62							8	Died	6	Died					8	Both animals dead.
2	Dichlorodifluoro-methane (Kinetic No. 12)	(CCl_2F_2)	2	64	64	89	84	**HF HCl (0.07)	0.18	**HF HCl (0.18)	0.39	Present (Qualitative)	0.02	17	Not affected	17	Not affected	24	Died	27	Died	44	Both animals dead.
3	Methylene chloride	(CH_2Cl_2)	3	79	68	118	100	HCl (0.11)	0.07	HCl (0.30)	0.09	Present (Qualitative)	0.06	20	Uncon-scious	20	Uncon-scious	9	Died	25	Died	45	Both animals dead.
4	Methyl chloride	(CH_3Cl)	2	97	95	138	111	HCl (0.03)	0.69	HCl (0.11)	1.16	Absent (Qualitative)	0.09	17	Intoxi-cated Helpless	17	Intoxi-cated Helpless	10	Died	20	Died	37	Both animals dead.
5	Carbon tetra-chloride	(CCl_4)	4	93	77	102	95	HCl (0.06)	0.20	HCl (0.11)	0.33	Present (Qualitative)	0.05	19	Intoxi-cated Helpless	19	Intoxi-cated Helpless	30	Barely alive	30	Barely alive	49	Test completed. Both animals removed alive. Both dead 3 hrs. later.
6	Carbon dioxide	(CO_2)	13	70	70	84	80						0.02	28	Not affected	28	Not affected	30	Not greatly affected	30	Not greatly affected	58	Test completed. Both animals removed alive. No apparent after effects.
7	Ammonia	(NH_3)	6	77	66									9	Died	6	Died	Mixture ignited by spark				9	Both animals dead.
8	Propane (A)	(C_3H_8)	3	79	59	74	64							18	Not affected	18	Not affected					18	Both animals removed alive.
8	Propane (B)	(C_3H_8)	3	(Circulated for 7 minutes)														Mixture ignited by spark				10	No animals used.
9	Isobutane	(C_4H_{10})	4	(Circulated for 10 minutes)														Mixture ignited by spark				14	No animals used.

***The figures obtained on phosgene ($COCl_2$) determination were as follows:**
Kinetic No. 12 .009; Carbon tethachloride .005; Methyl dichloride .028

Since it was not possible to make duplicate determinations, and since two of the three figures are almost beyond the accuracy of the method employed, it would appear unwise to accept them quantitatively, and they have therefore been reported as indications of the definite presence of phosgene rather as quantitative estimations. The report of the Underwriters' Laboratories, (Appendix "B") should be consulted for further data on the formation of phosgene from Kinetic No. 12 in contact with flame.

****Recent examination of the relative toxicity of HF has shown it to be of the same general order of magnitude as HCl. (Authority—Dr. Robert A. Kehoe.)**

Tables Show Results of Two Series Of Comparative Tests

(Continued from Page 6, Column 5)

Test 4—Methyl chloride (CH_3Cl):
Part I

Ten pounds of methyl chloride was admitted in 2 minutes. The upper and lower temperatures at the start were 97° F. and 95° F., respectively. Both animals showed some loss of coordination 10½ minutes after start of admitting refrigerant and were intoxicated to the point of helplessness after 15 minutes.

Part II

The gas was lighted after 17 minutes and burned with a high, luminous flame, indicating that the methyl chloride near the flame was burning. Acid analyses on a previous run showed *(0.03)*% HCl and *(0.69)*% CO_2 15 minutes after the gas was lighted and *(0.11)*% CHl and *(1.16)*% CO_2 15 minutes later. Carbon monoxide was 0.09% 20 minutes after the gas was lighted. No phosgene was found.

The upper animal died 27 minutes after the start or 10 minutes after the gas was lighted; the lower animal, 10 minutes later.

The temperatures at the end of the test were 138° F. for the upper cage and 111° F. for the lower cage.

Test 5—Carbon tetrachloride (CCl_4):
Part I

Carbon tetrachloride was introduced through a ¼-in. copper tube behind the fan, the 10 pounds being admitted in 4 minutes. The temperatures for the upper and lower cages at the start were 93° F. and 77° F. Both animals were helplessly intoxicated 10 minutes after start of admitting the carbon tetrachloride, the lower animal being on the verge of respiratory failure at the end of 15 minutes.

Part II

The gas burners were lighted 19 minutes after the start of the test.

Acid analyses on a previous run showed *(0.06)*% HCl *and (0.20)*% CO_2 15 minutes after the gas was lighted; 15 minutes later, the HCl concentration was *(0.11)*% and CO_2, *(0.33)*%. Qualitative tests on a sample taken 13 minutes after the gas was lighted showed the presence of phosgene. After the gas had been burning 21 minutes, the CO concentration was 0.05%. Both animals were removed alive at the completion of the test, but died within 3 hours after removal.

The temperatures at the end of the test were 102° F. and 95° F. for the upper and lower cages respectively.

Test 6—Carbon dioxide (CO_2):
Part I

Ten pounds of carbon dioxide was introduced in 13 minutes. The temperature of both cages at the start was 70° F.

Part II

Fifteen minutes later, the gas was lighted and allowed to burn for 30 minutes. Twenty-two minutes after the flame was started, a determination of carbon monoxide showed 0.02%.

Both animals were removed at the end of the test in good condition. The final temperatures were: upper, 84° F., lower, 80° F.

Test 7—Ammonia (NH_3):
Part I

Ten pounds of propane was introto the test building in 6 minutes. The temperatures at the start of the test were 77° F. at the upper cage and 66° F. at the lower cage. Six minutes after the ammonia flow started, the lower pig died; the upper pig died 3 minutes later.

Part II

The ammonia was allowed to circulate for another minute when the gas was lighted. The ammonia ignited, and the spread of flame toward the ceiling was readily perceptible. Upon reaching the vicinity of the ceiling, the flames spread outward in all directions, developing moderate pressure and burning through the Cellophane glazing of the frames.

Test 8—Propane (C_3H_8):
Part I

Ten pounds of propane was introduced into the test building in 3 minutes. The temperatures at the cages were: upper, 79° F. and lower, 59° F. Fifteen minutes later, the two test pigs were removed, apparently unaffected. At this time, the temperatures at the cages were: upper 74° F.; lower, 64° F.

Part II

The test building was aired, closed and a second 10 pounds of propane was introduced in 3 minutes and was allowed to circulate for 7 minutes. The mixture was then ignited and exploded

Test 9—Isobutane (C_4H_{10}):
Part I

No animals were used in this test.

Part II

Ten pounds of isobutane was introduced in 4 minutes and allowed to circulate for 10 minutes. The refrigerant-air mixture was then ignited by a spark. The explosion started near the spark and rapidly spread throughout the room. The Cellophane was broken and ignited. There was apparently more flame than in the propane test, the curtains being noticeably scorched

This test concluded Series No. 1. The data obtained are summarized in Table No. 2.

Notes on Series I Tests

The acid formed during the time the gas was burning was nearly the same for all the halide refrigerants.

The life of the animals exposed varied considerably with different refrigerants.

During the tests on the halogen containing refrigerants, a blue haze appeared in the test building shortly after the gas was lighted. This effect is the same as that observed by Tyndall in his work on the decomposition of ethyl iodide and is due to the condensation of halogen acid and water vapor.

SERIES II TESTS

A series of tests was run with sulfur dioxide, Kinetic No. 12, methyl chloride, ammonia, propane, and isobutane, according to the following general procedure. Three and one-half pounds of refrigerant was introduced into the test building with an animal in each cage. The gas was lighted immediately after the refrigerant was admitted and kept burning at the rate of 20 cu. ft. per hour during the time of the test. Acid analyses were run 15 and 30 minutes after the gas was lighted. Samples for carbon monoxide determinations were taken 25 minutes after the start of the test.

Test 1—Sulfur dioxide (SO_2):

Three and one-half pounds of sulfur dioxide was admitted in 1 minute. The temperatures at the start were 66° F. and 62° F. at the upper and lower cages, respectively. The lower animal died 1½ minutes after the start of the test and the upper animal 12½ minutes later. The temperatures at the finish of the test were: upper, 73° F.; lower, 66° F.

Test 2—Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2):

Three and one-half pounds of Kinetic No. 12 was introduced in ½ minute. The temperatures at the start were: upper, 70° F.; lower 66° F. The acid analyses at the end of 15 minutes showed halogen acids 0.018% and 0.05% CO_2; at the end of 30 minutes, the halogen acids totaled 0.04% and 0.10% CO_2. Carbon monoxide at the 25-minute period was 0.006%. No phosgene was found.

Both animals were removed alive at the end of the test The upper animal died 3 minutes after removal; but the lower pig was apparently normal until Nov. 5, when it was killed for autopsy. (See Appendix "A" on page 9.)

Final temperatures were: upper, 84° F.; lower 73° F.

Test 3—Methyl chloride (CH_3Cl):

Three and one-half pounds was introduced in 1 minute. The temperatures of the cages were: 73° F. and 62° F. for the upper and lower cages.

Acid analyses 15 minutes after the start of the test showed 0.004% HCl, 0.09% CO_2; 15 minutes later, the HCl was 0.01% and CO_2, 0.21%. Carbon monoxide was found to be 0.02%. No phosgene was found.

Both animals were removed alive at the end of the test. The upper animal was dead 17 hours later. The lower animal was alive until Nov. 5, when killed for autopsy. (See Appendix "A.")

The temperatures at the finish of the test were: upper, 89° F.; lower 73° F.

Test 4—Ammonia (NH_3):

Three and one-half pounds of ammonia was introduced in 3 minutes. The temperatures of the cages were: upper, 75° F.; lower 72° F.

The lower animal died 7½ minutes after the start of the test and the upper animal 4½ minutes later.

The temperatures at the end of the test were: upper, 81° F.; lower, 75° F.

Test 5—Propane (C_3H_8):

No animals were used in this test. Three and one-half pounds of propane was added in 1 minute and the mixture ignited by a spark, which resulted in an immediate combustion of a definitely explosive character.

Test 6—Isobutane (C_4H_{10}):

No animals were used in this test. Three and one-half pounds of isobutane was introduced into the building in 2 minutes. The mixture in the building was ignited by a spark. The ensuing combustion resembled an explosion. The flame did not spread uniformly but seemed, rather, to burn in different parts of the building, indicating that sufficient time had not elapsed to provide for even distribution of the refrigerant vapor. Note: See Table No. 3 for summary of Series II Tests.

SERIES III TESTS

These tests consisted of exposing guinea pigs to various mixtures of refrigerants (or carbon tetrachloride) with air, in the absence of a flame. The animals were placed in tight exposure chambers 18x14x10 in. (approximately 1.5 cu. ft.) which were fitted with gasketed glass fronts. The air and refrigerant were individually metered through calibrated flow meters and passed into a mixing chamber. The gases were passed from the mixing chamber into the exposure chamber through a glass tube placed in one upper corner of the chamber. The outlet from the boxes was placed in one lower corner opposite the inlet. A false bottom of woven cane was secured 1 in. above the floor of the exposure chamber to insure even distribution of the gases and prevent the formation of gas pockets. All tubing carrying Kinetic No. 12 from the flow meter to the exposure chamber was glass or copper. (See photograph No. 6 on next page.)

The liquids used in these tests were mixed with air by passing them through a vaporizer. The concentration of these materials was controlled by regulating the liquid feed to the vaporizer.

Two animals were placed in each exposure chamber for each test. The time at which the animals died was recorded. The temperature in the chambers closely approximated that of outside air.

Test 1—Methyl chloride (CH_3Cl):

Two tests were run on this refrigerant.

Test 1-A—The animals were exposed to a concentration of methyl chloride equivalent to 10 pounds of refrigerant per 1,000 cu. ft. of air. Under these conditions, one pig died in 3 hours and 3 minutes; and the second pig, in 3 hours and 33 minutes.

Test 1-B—In this test, the animals

(Continued on Page 8, Column 1)

Table No. 3—Summary of Series II Tests

Three and one-half lbs. of refrigerant in 1,000 cu. ft. test building. Gas lighted immediately and kept burning during test. Maximum duration of test 30 minutes.

Test	Refrigerant	Smybol	Time to Introduce Minutes	Temperature at Cages: Start Upper °F	Start Lower °F	Finish Upper °F	Finish Lower °F	Analyses: 15 min. after start of test Total Halogen Acids %	15 min. CO₂ %	30 min. after start of test Total Halogen Acids %	30 min. CO₂ %	CO %	$COCl_2$ %	Exposure and Fate of Animals: After start of test Upper Mins.	Upper Fate	Lower Mins.	Lower Fate	Length of test Minutes	After effects on animals
1	Sulfur dioxide	(SO_2)	1	66	62	73	66							14	Died	1.5	Died	14	Animals dead.
2	Dichlorodifluoro-methane (Kinetic No. 12)	(CCl_2F_2)	.5	70	66	84	73	HF+HCl 0.018	0.05	HF+HCl 0.04	0.10	0.006	None	30	Lived	30	Lived	30	Animals removed alive. Upper animal died 3 minutes later.
3	Methyl chloride	(CH_3Cl)	1	73	62	89	73	HCl 0.004	0.09	HCl 0.01	0.21	0.02	None	30	Lived	30	Lived	30	Animals removed alive. Upper animal found dead 17 hours later.
4	Ammonia	(NH_3)	3	75	72	81	75							12	Died	7.5	Died	12	Animals dead.
5	Propane	(C_3H_8)	1	Ignited by spark and exploded														3	No animals used.
6	Isobutane	(C_4H_{10})	2	Ignited by spark and exploded														4	No animals used.

Summaries of Comparative Refrigerant Tests

COMMITTEE DEVISES SERIES 4 PROCEDURE

(Continued from Page 7, Column 5)

were exposed to a concentration of methyl chloride of 3.3 vol. per cent. Both animals were dead in 6½ hours.

Test 2—Methylene chloride (CH_2Cl_2):

*Test 2-A**—This test consisted of exposing two animals to a concentration of methylene chloride vapors equivalent to 10 pounds per 1,000 cu. ft. of air. One pig died after exposure for 1 hour and 42 minutes; the second pig lived 2 hours and 20 minutes.

*Test 2-B**—The concentration of methylene chloride in the second test was 3.3 vol. per cent. Exposed to this concentration, one pig died after 2 hours and 55 minutes; the second pig was dead 7 minutes later.

Test 3—Carbon tetrachloride (CCl_4):

As in the experiments of Series I, carbon tetrachloride was used in this test in the absence of a flame, to demonstrate its toxicity in comparison with that of the different refrigerants. One experiment was performed in which two pigs were exposed to air containing the equivalent of 10 pounds of liquid per 1,000 cu. ft. of air. One pig died in 47 minutes and the other in 1½ hours.

Test 4—Carbon dioxide (CO_2):

Two animals were exposed to air containing 10 pounds of CO_2 per 1,000 cu. ft. of air for a period of 6 hours. Except for a greatly increased respiration rate, the animals were apparently not affected.

Test 5—Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2):

Test 5-A—Two animals were exposed to Kinetic No. 12 at a concentration of 10 pounds per 1,000 cu. ft. of air for a period of 7½ hours. The animals were removed in good condition and no delayed effect appeared.

Test 5-B—Twelve hours later, these same pigs were exposed in a second test to air containing 20 vol. per cent of Kinetic No. 12. After exposure to this concentration for 7 hours, the animals were removed in apparently normal condition. The animals were kept for observation until Nov. 5, when killed for autopsy. They had not developed any symptoms in the intervening time. (See Appendix "A.")

Tests are summarized in Table No. 4.

Notes on Series III Tests

These tests show very definitely that the refrigerants tested, with exception of carbon dioxide and Kinetic No. 12, are toxic.

SERIES IV TESTS

The specifications for the tests in this series with the exception of Test III were decided upon by the committee appointed to take charge of this part of the program.

Tests using ½-pound of refrigerant were run with ammonia, sulfur dioxide, and Kinetic No. 12. A 2-pound test was run with Kinetic No. 12 and one test without any refrigerant.

Test 1—Sulfur dioxide (SO_2):

One-half pound of sulfur dioxide was admitted into the test building in 1 minute and the gas immediately lighted. At the end of 25 minutes, analysis showed the presence of 0.008% carbon monoxide.

The lower animal died 15 minutes after the start of the test and the upper animal 13 minutes later.

Test 2—Ammonia (NH_3):

One-half pound of ammonia was discharged into the test building in 1 minute and the gas lighted. The test was contained for 30 minutes at which time the animals were removed alive. Both animals were living until Nov. 5, when killed for autopsy. (See Appendix "A.")

Test 3—Blank:

A test was run with two pigs in the test building with the gas lighted but without any refrigerant. The temperatures at the start of the test were: upper 79° F.; lower, 68° F. The test was continued for a period of 80 minutes. Seventy minutes after lighting the gas, analysis showed the presence of 0.25% CO_2 and 0.005% carbon monoxide. Temperatures at end of test were: upper, 120° F.; lower, 100° F.

Both animals were removed alive and lived until Nov. 5, when killed for autopsy. (See Appendix "A.")

Test 4—Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2):

One-half pound of Kinetic No. 12 was admitted into the test building over a period of 15 minutes in order to simulate the conditions arising from a badly leaking refrigerator. The gas was lighted at the start of the test and left burning for 30 minutes. The animals were removed in apparently good condition and lived until Nov. 5, when killed for autopsy. (See Appendix "A".)

Acid analyses at the end of the test showed 0.06% halogen acids, and 0.09% CO_2. No phosgene was found.

The temperatures during the test rose from 77° F. to 102° F. at the upper cage and from 72° F. to 86° F. at the lower cage.

Test 5—Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2):

This test was similar to the previous test except that 2 pounds of Kinetic No. 12 was admitted in 15 minutes instead of ½-pound. The temperature at the start was 77° F. at the upper cage and 70° F. at the lower cage.

Analyses after the gas had been burning 30 minutes showed 0.05% halogen acids, 0.10% CO_2, and 0.006% carbon monoxide. No phosgene was found.

Both animals were removed at the end of the test in good condition and remained so until Nov. 5, when killed for autopsy. (See Appendix "A.")

Notes on Series IV Tests

The conditions of these tests were not sufficiently vigorous to cause death of any of the animals (with the exception of Test 1—SO_2) within the time set for the duration of the tests. These tests with Kinetic No. 12 are of a more practical nature than the previous tests and show that no hazard is caused by a leak of the size likely to occur in practice.

Etching of Glass

The electric light bulb and the glass thermometers exposed in the test building throughout the test, showed a very distinct etch. For effect of HF on glass in the observation window, see Appendix "D" on page 11.

Blood Tests for CO-Hemoglobin

The blood from the pigs which were killed in Series I and II was examined by the pyrotannic acid method for CO-hemoglobin. The resulting color tubes, together with a tube containing saturated CO blood and a tube containing normal blood, were exhibited on the second day of the test. The tests were all negative except in the pig from the upper cage in Test 3, Series I, Methylene chloride, which showed about 5% saturation of the blood with carbon monoxide. This quantity is too low to cause more than slight symptoms of carbon monoxide poisoning and undoubtedly contributed little or nothing toward killing the animal.

GENERAL CONCLUSIONS

No attempt is made in this report to set forth comparative conclusions as to the life and fire hazards which may be introduced should any of the refrigerants tested escape through leakage from refrigerator equipment. However, the factors set forth in the introduction should be considered when drawing conclusions.

In the introduction, the following statements appear: "When judging the possible hazard to life and property which may be introduced by the escape of a refrigerant, the following factors must be considered:

First: What effect will the refrigerant itself have on human life; i. e.

(a) Is it toxic?

(b) Is it irritating?

(c) If toxic, is its action immediate or delayed?

(d) If toxic, does it give sufficient warning of its presence?

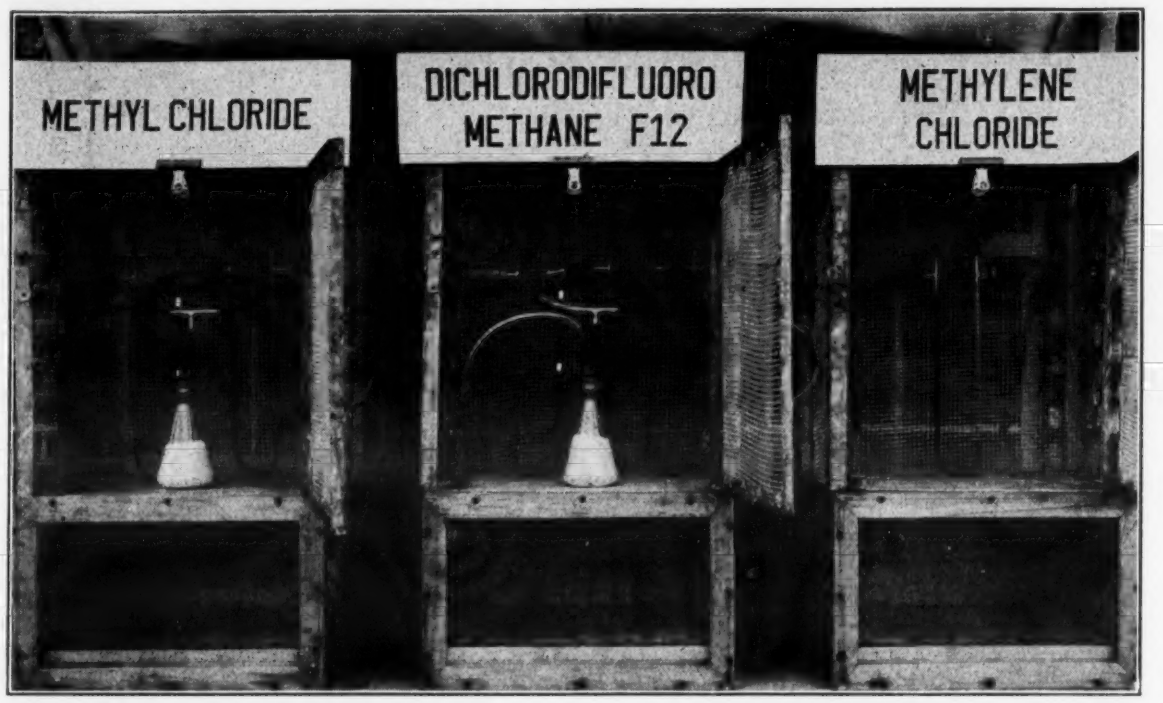
Second: Will the refrigerant or its vapor introduce fire or explosion hazards?

Third: Will its physical properties, such as vapor density, rate of evaporation or diffusion, increase the hazards?

Inasmuch as these characteristics are not influenced by any extraneous conditions, they are judged to be of prime importance.

Finally, after the above factors have been determined, consideration should be given to those contingencies which may aggravate existing hazards or even introduce new ones. As applied to the use of refrigerants in ordinary occupancies, this hazard narrows down to the possible formation of products of combustion or gases of decomposition brought about by the subjection of the refrigerant to the action of a high temperature; for instance, by bringing into contact with a flame."

Small Enclosures for Series 3



Photograph No. 6—Small enclosures used in Test Series No. 3. Immediately above exposure chamber are manometer tubes for controlling refrigerant and air admitted to the animal chambers. The flasks contain large glass beads in which the refrigerant and air were intimately mixed.

Table No. 4—Summary of Series III Tests

Experiments in absence of any flames. Two animals in each exposure chamber. Air supply 4.3 ft. per hr. per animal.

Test	Refrigerant	Lbs. per 1,000 cu.ft. air	% by vol.	Fate of Animals: 1st Animal Died Hours	1st Animal Died Mins.	2nd Animal Died Hours	2nd Animal Died Mins.
1-A	Methyl chloride (CH_3Cl)	10	8.5	3	3	3	33
1-B	Methyl chloride (CH_3Cl)	3.96	3.3	6	30	6	30
2-A	Methylene chloride (CH_2Cl_2)	10	5.0	1	42	2	20
2-B	Methylene chloride (CH_2Cl_2)	6.6	3.3	2	55	3	02
2	Carbon tetrachloride (CCl_4)	10	2.7	0	47	1	30
4	Carbon dioxide (CO_2)	10	9.9	Both removed alive after 6 hrs.			
*5-A	Dichlorodifluoromethane Kinetic No. 12 (CCl_2F_2)	10	3.3	Both removed alive after 7½ hrs.			
5-B	Dichlorodifluoromethane Kinetic No. 12 (CCl_2F_2)	60.6	20.0	Both removed alive after 7 hrs			

*The same animals were used in Test 5-B that had been removed from Test 5-A the previous day.

Engineers' Analysis Of Kinetic No. 12

Kinetic No. 12, Dichlorodifluoromethane, analyzed according to the above outline, shows the following:

First: It is non-toxic and non-irritating; and, therefore, is not of itself dangerous to human life.

Second: Neither Kinetic No. 12 nor its vapor introduces fire or explosion hazards, being non-combustible; and, therefore, does not endanger either life or property. (See Underwriters' Laboratories' report, Appendix "B.")

Third: It is obvious that since it is neither toxic, irritating nor combustible, its physical properties could not increase these hazards.

Practically, the only hazard which may be introduced through the use of Kinetic No. 12 as a refrigerant is a very remote health hazard which might be presented should leakage occur and the vapors come into direct contact with an open flame or high temperature and be decomposed. Even in such a case, in order to bring about an appreciable health hazard, there must be the following combination of circumstances:

(a) The release of a large quantity of Kinetic No. 12 in a tightly confined space.

(b) The presence of flame or other high temperature.

(c) Circulation of the atmosphere within the space so that the heavy vapors of the refrigerant will be brought into direct contact with the flame or high temperature, for only those vapors in direct contact will be decomposed.

(d) No ventilation to the outside such as would be provided by open doors or windows or mechanical ventilation, for if there is ventilation to the outside, the vapors of the refrigerant and whatever products of decomposition there are, will escape.

Finally, if these circumstances were all present, the harmful products of decomposition would be pungent and irritating, rendering them noticeable in minute quantities and giving ample warning to prevent prolonged exposure long before concentrations dangerous to health are reached.

As stated in the introduction, these tests were intended for purposes of comparison. The probability of conditions ever arising similar to those set up during the tests is exceedingly remote. For example:

(a) a small hermetically sealed room with absolutely no outside ventilation containing

(b) two open gas flames.

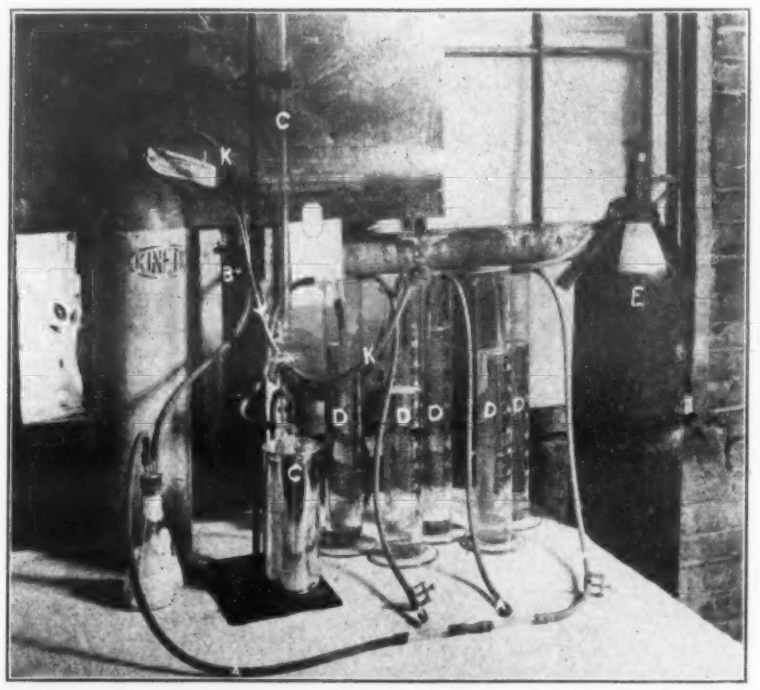
(c) 3½ pounds of the refrigerant discharged into the test building almost immediately, or the excessively large charge of 10 pounds in a very short time, (See Tables Nos. 2 and 3), bringing about conditions far more severe than any which would ever result from average leaks, while

(d) the atmosphere in the room was circulating at high velocity to bring the vapors of the refrigerant into contact with the two gas flames.

In conclusion, should the severe conditions intentionally set up during the tests ever develop in actual practice, it is almost beyond the limits of probabil-

(Continued on Page 9, Column 1)

Controls For Exposure Test



Photograph No. 7—Controls for exposure chambers of photograph No. 6. "A" designates air connections from air supply line "B." "K" connects the F-12 cylinder through pressure regulator to its exposure chamber. "C" marks the burette and mixing chamber for liquid refrigerants. "D" indicates pressure regulators for refrigerants and air. "E" is the gaseous refrigerant supply cylinder.

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Appendices for Tests on Common Refrigerants

(Continued from Page 8, Column 5)

ity that there would be present any person who could not or would not recognize the warning gases and either ventilate the room or leave.

Appendix A

OBSERVATIONS ON GUINEA PIGS USED IN TESTS

By Dr. Robert A. Kehoe
Kettering Laboratory of Applied Physiology, University of Cincinnati, Cincinnati, Ohio.

SERIES I

Test 1—Sulphur Dioxide (SO_2)

The lungs are very pale and very voluminous, being distended to their maximal capacity. There are no haemorrhages in the lung tissue, bronchi, or trachea There is slight evidence of edema of the lung tissue, but no free fluid is present.

The liver and spleen are deeply congested but are not otherwise remarkable.

The kidneys are pale but otherwise normal.

No examination of the brain was made.

Test 2—Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2)

The lungs are pale, voluminous, and free of haemorrhage. Some interstitial edema is present.

The liver and spleen are moderately congested, but not otherwise remarkable.

The kidneys are slightly congested.

Test 3—Methylene Chloride (CH_2Cl_2)

Many petechial haemorrhages are diffusely scattered through the lung tissue. The lower lobes on either side show massive congestion with haemorrhages. The tissue is edematous throughout, but no free fluid is present in the bronchi.

The liver and spleen are very deeply congested. The liver is mottled in irregular fashion, and shows an increased fragility.

The kidneys are dark red, congested and slightly swollen.

Test 4—Methyl Chloride (CH_3Cl)

The lungs are pale and voluminous. There are no haemorrhages.

The liver, spleen and kidneys are deeply congested.

The heart is dilated.

Test 5—Carbon Tetrachloride (CCl_4)

The lungs are voluminous, with numerous large haemorrhages and much edema.

The liver and kidneys and spleen are deeply congested.

Test 6—Carbon Dioxide (CO_2)

Survived. No pathological condition evident. These animals used again in Series IV Test V.

Test 7—Ammonia (NH_3)

The lungs are very pale, voluminous and dry. No haemorrhages of lung, bronchi or trachea are seen.

The other tissues are not remarkable.

Test 8—Propane (C_3H_8)

Survived. No pathological condition evident. These animals were used again in Series IV Test IV.

Test 9—Isobutane (C_4H_{10})

No animals were used in this test.

SERIES II

Test 1—Sulphur Dioxide (SO_2)

Findings similar to those described for animals in Series I, Test 1. The only variant is that there was somewhat more congestion of the lungs than in the previous animals.

Test 2—Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2)

The top pig died immediately after the test. The findings were similar to those previous described for the pigs in Series I, Test II.

The bottom pig survived, was ill at no time, and was killed for autopsy Nov. 5. No abnormalities of the tissues were found.

Test 3—Methyl Chloride (CH_3Cl)

The animal in top cage died. The lungs show a very deep congestion and edema with heamorrhages into the parenchyma.

The liver is very deeply congested, mottled and very fragile.

The kidneys and spleen are very dark, with wide dilitation of the vessels.

The animal in bottom cage survived, being ill for only a short time after the test (about two hours). Killed for autopsy Nov. 5. There are a few petechial haemorrhages in the lungs, but no other abnormalities are seen.

Test 4—Ammonia (NH_3)

Findings similar to those previously described, for animals in Series I. Test VII.

Test 5—Propane (C_3H_8)

No animals were used in this test.

Test 6—Isobutane (C_4H_{10})

No animals were used in this test.

SERIES III

Test 1-A and 1-B—Methyl Chloride (CH_3Cl)

The lungs show a general congestion, with petechial haemorrhages throughout, and larger haemorrhages here and there.

Test 2-A and 2-B—Methylene Chloride (CH_2Cl_2)

The lungs show variable sized haemorrhages into the pleura and into the interstitial tissue. Deep congestion is present in the dependent tissue, with two areas of massive haemorrhage.

The heart is greatly dilated and flabby, with haemorrhage into the pericardial sac, and beneath the epicardium.

The liver is exceeding friable, with diffuse focal necrosis.

The spleen is heavily congested, and the kidneys are swollen and congested.

Test 3—Carbon Tetrachloride (CCl_4)

The lungs show a generalized deep congestion with general edema.

The heart is dilated and flabby.

The liver is mottled, very fragile, and congested.

The kidneys and spleen are congested.

Test 4—Carbon Dioxide (CO_2)

Both animals survived. Apparently healthy. Killed Nov. 5.

One animal showed areas of dark red congestion with (presumably) early consolidation suggestive of a lobular pneumonia. (Probably the result of exposure and infection, unrelated to the treatment). The other showed no evidence of pathological condition.

Test 5-A and 5-B—Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2)

Survived. No illness. Killed Nov. 5. No pathological condition evident.

SERIES IV

Test 1—Sulphur Dioxide (SO_2)

Findings similar to those previously described for animals in Series II, Test I.

Test 2—Ammonia (NH_3)

Animals ill after test, frothy bloody fluid extruding from nostrils, Remained ill for several days but improved and apparently recovered by Nov. 5 at which time they were killed.

The lungs in both animals show haemorrhages (healing) into the lung parenchyma and small haemorrhages along the mucous membrane of the bronchi and trachea.

No other pathological conditions are found.

Test 3—Blank Test

Animals survived. Top animal weak and ill for a time. Recovered in a few hours. Apparently well afterward. Killed Nov. 5. No pathological condition evident.

Test 4—Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2)

Animals survived. No apparent illness. Killed Nov. 5. No pathological condition evident.

Test 5—Dichlorodifluoromethane (Kinetic No. 12—CCl_2F_2)

Survived. No apparent illness. Killed Nov. 5. Necropsy findings:

One animal showed evidence of a small haemorrhage into one lung. No other lesions present. The other showed no evidence of abnormalities.

Appendix B
UNDERWRITERS' REPORT

Report of dichloro-difluoro-methane (Kinetic No. 12), a product of Kinetic Chemicals, Inc., Wilmington, Del., prepared by the Underwriters' Laboratories. Miscellaneous Hazard No. 2256. Application No. 31C1684. Oct. 10, 1931.

Introduction

The submittor has developed a new refrigerant which he has found desirable for use in domestic refrigerators, both single and multiple types.

Tests have been conducted with this refrigerant to obtain data bearing on its stability, nonflammability, decomposition products when exposed to flame and hot metal surfaces, and to determine whether it has any corrosive action on certain common metals.

DESCRIPTION

General Character

Dichloro-difluoro-methane, CCl_2F_2 is a halogen derivative of methane marketed under the trade name of "Kinetic No. 12."

Dichloro-difluoro-methane is a colorless gas heavier than air (sp. gr. 4.18, air =1) and resembling chloroform in odor. It has a boiling point of -30 C (-22 F) and a freezing point of -155 C (-247 F). At ordinary temperatures it is a liquid when under a pressure of about 75 lb. per sq. in. (75 lb. sq. in. at 22 C).

The gas is shipped liquefied under pressure in steel cylinders similar to those used for chlorine. The cylinders are constructed and tested in accordance with the specifications of the I. C. C. Regulations applying.

Plan of Investigation

The object of this investigation was to determine the nature of the recommendation to be made relative to the fire hazard of the product.

The investigation was made in accordance with the following outline which indicates in the first vertical column the separate phases or main divisions; in

Tests for corrosive action of dichloro-difluoro-methane on metals commonly used in refrigeration systems were conducted under conditions in which water was absent.

In order to obtain data bearing on the stability and the nature of its decomposition products when in contact with flames or hot surface, mixtures of dichloro-difluoro-methane and air were exposed to test fires and heated surfaces in a specially designed apparatus. A series of tests were also conducted in a small test room, in which mixtures of dichloro-difluoro-methane and air were exposed to the flames produced by an ordinary gas range. Guinea pigs were placed in the test room during a number of the tests.

Examination and Test Record

DESCRIPTION OF SAMPLES

The manufacturer furnished three cylinders each containing about 25 lb., and later on, two cylinders each containing 130 lb., of liquefied dichloro-difluoro-methane.

IDENTIFICATION AND ANALYTICAL TESTS

Method

A sample of the product in the gaseous phase was subjected to qualitative tests for carbon, chlorine, and fluorine in chemical combination. The sample was decomposed by means of a combustion train, hot copper oxide being used as the decomposing reagent.

The density of the product in the gaseous phase was determined by weighing a glass bulb of known volume both when evacuated and when filled with the product at atmospheric pressure. The temperature of the sample and the barometric pressure during the determination were recorded. The weight of a liter of the gas under standard conditions and its density as compared with air were calculated from the above data.

Results

The product was found to consist of carbon, chlorine, and fluorine in chemical combination.

The density of the product in the gaseous phase (air = 1) was found to the second column the various features involved in each phase; and, in the third column the titles of the tests or means by which the information relative to each feature was obtained.
be 4.21. The density of dichloro-difluoro-methane (air = 1) is 4.18.

The weight of one liter of the product in the gaseous phase at standard conditions (0 C and 760 mm. mercury) is 5.44 g.

FLAMMABILITY TESTS

Method

Apparatus

Apparatus for Preparation of Mixtures of Dichloro-Difluoro-Methane and Air—The mixtures of dichloro-difluoro-methane and air are prepared in predetermined proportions by means of a specially constructed carburetor system. Dichloro-difluoro-methane in the gaseous phase is added to the main air intake pipe of the system. The concentration of the gas is controlled by means of capillary flow meters operating in conjunction with constant head regulators.

Apparatus for Dichloro-Difluoro-Methane and Air Determinations—A modified Burrell gas analysis apparatus is used to determine the percentage of dichloro-difluoro-methane in the mixtures with air. It consists of a glass liquefaction bulb having a side arm to which is attached a mercury manometer. The inlet of the bulb is provided with a three-way stop cock which connects on one side to a vacuum pump and on the other side to a U tube, one arm of which is provided with connection to the sampling tubes. Water vapor is removed from the sample by means of crushed anhydrous magnesium perchlorate contained in the U tube through which the sample passes as it enters the bulb. Liquefaction and freezing of the dichloro-difluoro-methane vapor in the bulb is accomplished by cooling with liquid oxygen contained in a Dewar flask. After freezing the vapor, the air in the bulb is removed by means of the vacuum pump. On allowing the liquid to vaporize in the bulb, its pressure is measured by means of the mercury manometer and the percentage of vapor in the sample calculated.

In applying this method of analysis, its reliability and accuracy were first verified by tests upon vapor-air mixtures containing known amounts of dichloro-difluoro-methane.

Sampling Tubes—For the purpose of obtaining samples of vapor-air mixtures for analysis, glass sampling tubes of about 200 cc. capacity are employed. Mercury is used as the confining liquid.

The sampling tubes are cleaned, dried, and refilled with vacuum distilled mercury at frequent intervals.

Test Apparatus—The test apparatus is a specially designed cylindrical steel vessel about 6 in. in diameter and 26 in. in length provided with inlet and outlet connections to the carburetor system. Both spark electrodes and an illuminating gas burner of the Bunsen type are used for the purpose of ignition. A mica window is provided in order to permit observation of the vapor-air mixture in the vessel during test. The initial temperature of the vapor-air mixture in the vessel is measured by means of an iron-constantan thermocouple operating in conjunction with an indicating potentiometer. For the purpose of recording explosion pressure, a Crosby gas engine indicator is connected to the vessel.

Test Procedure

The vapor-air mixture was allowed to flow through the test apparatus until the original air was displaced. Samples of the mixture were withdrawn for analysis from the apparatus and from the line carrying the incoming mixture. The inlet and outlet valves of the apparatus were then closed and an attempt made to ignite the vapor-air mixture by means of an electric spark between electrodes spaced ¼ in. apart within the test vessel. An illuminating gas burner of the Bunsen type, inserted while burning through a small opening in one end of the vessel, was used as an alternate source of ignition in some of the tests. At the conclusion of each test, the apparatus was purged of decomposition products by means of a stream of air.

The first series of tests were conducted at room temperature and at an initial pressure of one atmosphere (750 mm. mercury, absolute) employing mixtures containing various percentages of dichloro-difluoro-methane.

The second series of tests were conducted at an initial temperature of about 100 C (212 F) and an initial pressure of one atmosphere (750 mm. mercury, absolute).

Results

The results of the tests are shown in Table I following.

No evidence of flame propagation was observed in any dichloro-difluoro-methane vapor-air mixture when tested in the chamber either at room temperature or at an initial temperature of 100 C (212 F). Both the electric spark and the illuminating gas flame were used as sources of ignition. No evidence of an explosive reaction (rise of pressure) was recorded by the Crosby indicator in any of the tests.

The dichloro-difluoro-methane vapor was partially decomposed by both the electric spark and the gas flame as indicated by the presence of its decomposition products in the gases expelled from the chamber after each test.

APPARENT IGNITION TEMPERATURE TESTS

Method

The apparatus employed for this test consists of a conical quartz flask of 160 cc. capacity and having a ratio of surface to volume of 1.1 immersed in a solder bath heated by means of gas burners. The temperature of the solder bath is measured by means of a themocouple and an indicating potentiometer.

The test consists in dropping one or more drops of dichloro-difluoro-methane in the liquid phase into the flask at

(Continued on Page 10, Column 1)

Plan of Investigation

GENERAL NATURE	Composition Stability	Identification and Analytical Tests. Study of Chemical Nature
FIRE HAZARD	Flammability of Mixtures of Dichloro-Difluoro-Methane and Air	Flammability Tests Apparent Ignition
	Apparent Ignition Temperature of Dichloro-Difluoro-Methane in Air	Temperature Tests
TOXICITY	Toxicity of Dichloro-Difluoro-Methane	Study of Available Data
CORROSIVE ACTION	Corrosive Action on Many Common Metals in Presence and Absence of Moisture	Corrosion Tests
DECOMPOSITION PRODUCTS	Flammability of Products of Decomposition, and Their Nature and Toxicity	Tests in Special Apparatus. Tests in Small Room Using Guinea Pigs
UNIFORMITY	Comparison of the Composition of the Various Samples	Identification and Analytical Tests Study of Chemical Properties
PRACTICABILITY OF CONTROL	Working Pressure	Consideration of Physical and Chemical Properties

TABLE I
Flammability Tests
Dichloro-Difluoro-Methane Vapor-Air Mixtures

Test No.	CCl_2F_2 in Mixture. Per Cent by Volume	Initial Temperature of Mixture	Source of Ignition	Results
DDM 1	4.39	20 C (Room)	Spark	Did not propagate flame
DDM 2	4.17	" "	Flame	" " " "
DDM 3	4.71	" "	Spark	" " " "
DDM 4	4.57	" "	Flame	" " " "
DDM 5	5.56	" "	Spark	" " " "
DDM 6	5.45	" "	Flame	" " " "
DDM 7	6.12	" "	Spark	" " " "
DDM 8	6.00	" "	Flame	" " " "
DDM 9	8.32	" "	Spark	" " " "
DDM 10	8.26	" "	Flame	" " " "
DDM 11	7.17	" "	Spark	" " " "
DDM 12	6.96	" "	Flame	" " " "
DDM 13	10.72	" "	Spark	" " " "
DDM 14	10.67	" "	Flame	" " " "
DDM 15	15.43	" "	Spark	" " " "
DDM 16	16.39	" "	Flame	" " " "
DDM 17	14.73	" "	Spark	" " " "
DDM 18	14.86	" "	Flame	" " " "
DDM 19	16.43	" "	Spark	" " " "
DDM 20	19.58	" "	"	" " " "
DDM 21	30.66	" "	"	" " " "
DDM 22	27.83	" "	"	" " " "
DDM 23	24.49	" "	"	" " " "
DDM 24	19.72	" "	"	" " " "
DDM 25	20.97	" "	"	" " " "
DDM 26	17.84	" "	"	" " " "
DDM 27	18.02	" "	"	" " " "
DDM 28	16.84	" "	"	" " " "
DDM 29	11.13	" "	"	" " " "
DDM 30	12.09	" "	"	" " " "
DDM 31	13.48	" "	"	" " " "
DDM 32	10.26	" "	"	" " " "
DDM 33	9.00	" "	"	" " " "
DDM 34	5.87	" "	"	" " " "
DDM 35	5.01	" "	"	" " " "
DDM 36	3.87	" "	"	" " " "
DDM 37	1.38	" "	"	" " " "
DDM 38	3.14	" "	Flame	" " " "
DDM 39	2.94	" "	Spark	" " " "
DDM 40	1.05	" "	"	" " " "
DDM 41	7.32	102 C	"	" " " "
DDM 42	11.43	103 C	"	" " " "
DDM 43	14.87	103 C	"	" " " "
DDM 44	15.62	102 C	Flame	" " " "
DDM 45	17.10	102 C	Spark	" " " "
DDM 46	17.00	20 C (Room)	Flame	" " " "
DDM 47	17.07	103 C	"	" " " "
DDM 48	17.83	100 C	Spark	" " " "
DDM 49	21.03	100 C	Flame	" " " "
DDM 50	4.21	103 C	Spark	" " " "
DDM 51	1.55	103 C	"	" " " "

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each interval of 5 C (9 F). The lowest temperature at which ignition (without application of flame) can be obtained is taken as the apparent ignition temperature.

Samples of the dichloro-difluoro-methane in the gaseous phase were also introduced into the flask by means of a glass tube of 9-32 in. bore provided with a bulb.

Results

No apparent ignition of dichloro-difluoro-methane was observed up to 750 C (1320 F).

CORROSION TESTS

Method

Test specimens ⅜ in. in width and ranging in length from 3 to 6 in. were cut from sheets of aluminum, zinc, brass, and phosphor bronze. The specimens were buffed, measured, cleaned thoroughly with soap and water, washed with ether, dried, and weighed. The surface area of the individual specimens was also calculated. Each specimen was placed in a separate glass tube about 12 in. in length and 14 mm. in internal diameter, the tubes being sealed at one end. The tubes were then evacuated and heated so as to remove all traces of moisture. While still evacuated, the sealed ends of the tubes were immersed in liquid oxygen as a cooling medium and dichloro-difluoro-methane allowed to distill from the shipping cylinder through a system of three-way stop cocks and connections which were free from moisture and condense in the tubes, the dichloro-difluoro-methane at no time being in contact with the atmosphere. When the tubes were about one-third filled with liquid dichloro-difluoro-methane, they were disconnected from the cylinder and the open ends sealed while the tubes were still immersed in liquid oxygen, a drying tube filled with anhydrous magnesium perchlorate being used to prevent moisture coming in contact with the liquid during the sealing process. The sealed tubes were then placed in a specially designed furnace and heated to a temperature ranging from 100 to 110 C. The furnace was in operation about eight hours a day, except that on each Saturday it was turned off at noon until the following Monday morning. The tubes were allowed to stand in the furnace between the heating periods.

Specimens Examined

At the conclusion of the test, the tubes were opened and the metal specimens examined visually for evidences of corrosion. The specimens were cleaned, washed with ether, dried, weighed, and the change in weight per square centimeter of surface area calculated.

A tube containing dichloro-difluoro-methane only was also prepared and heated according to the procedure previously described.

The corrosive action of dichloro-difluoro-methane in the presence of water was determined on iron, aluminum, copper, zinc, silver, tin-lead solder, phosphor bronze, yellow brass, yellow brass and tin-lead solder, and iron and tin-lead solder. Test specimens of these metals were prepared according to the procedure previous described. Each specimen was placed in a separate glass tube about 12 in. in length and 14 mm. in internal diameter, the tubes being sealed at one end. A few drops of distilled water were introduced into each tube. The sealed ends of the tubes were placed in liquid oxygen as a cooling medium and liquid dichloro-difluoro-methane introduced into the tubes. When the tubes were about one-third filled with the liquid, the open ends of the tubes were sealed while they were still immersed in liquid oxygen. The sealed tubes were then placed in the furnace and subjected to the same cycle of heating as previously described.

Effect of F-12 Alone

At the conclusion of the test, the tubes were opened and the metal specimens examined visually for evidences of corrosion. The specimens were cleaned, washed with ether, dried, weighed, and the change in weight per square centimeter of surface area calculated.

A tube containing dichloro-difluoro-methane and distilled water only was prepared and heated according to the procedure previously described.

Results

The specimens of aluminum, zinc, brass, and phosphor bronze after being sealed in glass tubes with dichloro-difluoro-methane under its own vapor pressure for 912 hr., during 190 hr. of which they were heated to 100-110 C, showed no visual evidences of corrosion except for a slight darkening of the surfaces. There was no preceptible pitting of the surface of any of the specimens. The change in weight per unit area of surface was found to be small (less than 1 mg. per sq. cm.).

The specimens of iron and iron and tin-lead solder after being sealed in glass tubes with dichloro-difluoro-methane and water for 912 hr., during 190 hr. of which they were heated to 100-110 C, were found to be heavily corroded and the surfaces badly pitted. The surface of the zinc specimen was also found to be heavily corroded and pitted under the same conditions. The surface of the copper specimen was completely covered by a black deposit, but showed no evidence of deep pitting. The surfaces of the specimens of yellow brass and yellow brass and tin-lead solder were were partially covered with a black deposit but showed no evidences of pitting. The aluminum specimen was partially covered with a white discoloration and the surface showed some evidences of pitting. The specimens of silver, phosphor bronze, and lead-tin solder showed no indications of corrosion except for a slight darkening of the surfaces. The zinc specimen gained in weight 3.3 mg. per sq. cm. and the iron specimens gained in weight 0.8 mg. per sq. cm during the test period. The change in the weight of the other specimens was small (less than 1 mg. per sq. cm.).

The glass tubes used in the tests with dichloro-difluoro-methane and water showed evidences of etching, indicating the presence of hydrogen fluoride.

DECOMPOSITION TESTS

Method

The test apparatus is a specially designed cylindrical steel vessel about 6 in. in diameter and 26 in. in length, having a mica observation window. Both spark electrodes and an illuminating gas burner of the Bunsen type are provided as sources of ignition. The relative temperature within the vessel is measured by means of an iron-constantan thermocouple operating in conjunction with an indicating potentiometer.

Determination of Dichloro-Difluoro-Methane in Air—A modified Burrell gas analysis apparatus is used to determine the percentage of dichloro-difluoro-methane in mixtures with air. Water vapor is removed from the sample by means of crushed anhydrous magnesium perchlorate.

For the purpose of obtaining samples of vapor-air mixtures for analysis, glass sampling tubes of about 200 cc. capacity are employed. Mercury is used as the confining liquid.

The sampling tubes are cleaned, dried, and refilled with vacuum distilled mercury at frequent intervals.

The accuracy of this method of analysis was first verified by tests upon vapor-air mixtures containing known amounts of dichloro-difluoro-methane.

Determination of Hydrogen Chloride and Hydrogen Fluoride in Air—In determining the percentages of hydrogen chloride and hydrogen fluoride in air a two-liter sample of the mixture is passed through a bubbling tower containing pure distilled water as an absorbing liquid. A calibrated aspirator bottle filled with water is used for the purpose of drawing the sample through the tower. All glass apparatus which comes in contact with hydrogen fluoride is coated with a wax mixture having a high melting point.

The aqueous solution of hydrogen chloride and hydrogen fluoride is titrated with a standard solution of potassium hydroxide. The hydrogen fluoride in the solution is determined by titration with standard cerous nitrate solution, using methyl red as an indicator. The hydrogen chloride is then calculated by difference from the results of the potassium hydroxide and cerous nitrate titrations and the results checked by gravimetric determination of the hydrogen chloride as silver chloride. Corrections are applied when appreciable quantities of chloride and phosgene are present in the mixture. The percentage of hydrogen chloride and hydrogen fluoride in air are calculated on the basis of dry gases under standard conditions.

The accuracy of this method of analysis was first verified by tests with aqueous solutions containing known amounts of hydrogen chloride and hydrogen chloride and hydrogen fluoride.

Determination of Chloride in Air—In determining the percentage of free chlorine in air, a two-liter sample of the mixture is drawn through a bubbling tower containing aqueous potassium iodide solution. All glass apparatus which comes in contact with hydrogen fluoride is coated with a wax mixture having a high melting point.

The liberated iodine is determined by means of titration with standard sodium thiosulphate solution. The percentage of chlorine in air is calculated on the basis of dry gases under standard conditions.

Determination of Phosgene in Air—In determining the percentage of phosgene in air, a two-liter sample of the mixture is drawn through a bubbling tower containing a freshly prepared solution of aniline in water.

Phosgene combines with the aniline solution to form diphenylurea. The diphenylurea is removed from the solution by filtration, purified, dried, and weighed. One molecule of phosgene is equivalent to one molecule of diphenylurea. The percentage of phosgene in air is calculated on the basis of dry gas under standard conditions.

Chlorine interferes with the reaction and is removed by passing the sample through a tube containing powdered metallic antimony. Hydrogen chloride does not interfere with the reaction.

Test Procedure

Oil Fires—A small pan about 3 in. in diameter and 2 in. in depth containing the flammable liquid was placed in the cylindrical test chamber. The chamber was then sealed and the liquid ignited by means of an illuminating gas burner of the Bunsen type inserted while burning through a small opening in the chamber. A stream of air was passed through the chamber in order to maintain the combustion of the liquid. When the liquid had been burning for about five minutes, dichloro-difluoro-methane was introduced into the air stream entering the cylinder, the proportions of dichloro-difluoro-methane and air being regulated so that the mixture was just able to support combustion.

F-12 Mixed With Air

Samples of the dichloro-difluoro-methane and air mixture entering the cylinder were selected for analysis. Samples of the fumes formed by the passage of the dichloro-difluoro-methane and air through the flame were also selected and examined for hydrogen chloride, hydrogen fluoride, free chlorine, and phosgene. A complete analysis of the products of combustion from the fire and the decomposition products of dichloro-difluoro-methane was not attempted. As a qualitative test for the presence of hydrogen fluoride in the fumes, a piece of glass tubing was placed in the outlet pipe line from the cylinder between the point at which the samples were selected and the end of the pipe line. The presence of hydrogen fluoride is indicated by its etching action on the glass tubing.

Two tests were conducted with burning cleaning fluid representing the highly refined petroleum products.

A test was also conducted with burning domestic oil burner fuel oil of a grade representative of the class.

Wood Fire—About 370 g. of yellow pine in the form of sticks 3½ by ½ by ¼ in. was arranged in the form of a lattice within the cylinder. The wood was ignited by means of a Bunsen burner and the test conducted in accordance with the procedure described above in connection with the tests with oil fires.

Hot Metal Surfaces—The cylindrical test chamber was heated by means of gas burners so that the lower half was dull red (about 550 C). Mixtures of air and dichloro-difluoro-methane in known proportions were then passed through the heated chamber. Samples of the fumes were removed and examined for hydrogen chloride, hydrogen fluoride, chlorine, and phosgene. Samples of the fumes were also examined for carbon dioxide, oxygen, and carbon monoxide, the usual form of the Orsat apparatus being employed in the tests. A piece of glass tubing was also placed in the outlet from the test chamber, the presence of hydrogen fluoride in the decomposition products being qualitatively indicated by its etching action on the glass.

In order to obtain data on the flammability of the decomposition products of dichloro-difluoro-methane when exposed to hot surfaces, samples were mixed with known amounts of air and subjected to sparks produced by an induction coil while confined in an explosion pipette of the Hempel type.

Results

Oil Fires—The decomposition products of dichloro-difluoro-methane when in contact with burning petroleum products were found to include hydrogen chloride, hydrogen fluoride, and phosgene. No free chlorine was found in the fumes from the chamber during any of the tests. The test results are given in Table II under Test Nos. 1, 2, and 3.

NOTE: The absence of free chlorine is probably due to the fact that both hydrocarbons and water vapor (a product of the combustion of petroleum products and wood) are present in every case in large quantities and any chlorine formed by decomposition of dichloro-difluoro-methane would probably react with the hydrocarbons or water, or both, at the temperatures existing in the test chamber and form hydrogen chloride.

The glass specimen placed in the outlet pipe line from the test chamber was heavily etched at the conclusion of the test, indicating the presence of hydrogen fluoride in the fumes.

F-12 With Wood Fire

Wood Fire—The decomposition products of dichloro-difluoro-methane when in contact with a wood fire were found to include hydrogen chloride, hydrogen fluoride, and phosgene. No free chlorine was found in the fumes from the chamber during the test. The test results are given in Table II under Test No. 4.

The odor of the fumes was irritating.

The glass specimen placed in the outlet pipe line from the test chamber was found to be heavily etched at the conclusion of the test, indicating the presence of hydrogen fluoride in the fumes.

Hot Surfaces — The decomposition products formed when mixtures of dichloro-difluoro-methane and air are exposed to hot iron surfaces were found to include hydrogen chloride, hydrogen fluoride, free chlorine, and phosgene. The test results are given in Table II under Test Nos. 5 and 6. No examination for minute quantities of carbon monoxide was conducted.

The fumes formed by the decomposition of a mixture of dichloro-difluoro-methane when in contact with hot iron surfaces were found to be nonflammable and noncombustible when mixed with air in any proportions.

The odor of the fumes was irritating.

The glass specimen placed in the outlet pipe line from the test chamber was etched, indicating the presence of hydrogen fluoride in the fumes.

TABLE II

Decomposition Tests With Dichloro-Difluoro-Methane Tests Conducted in Specially Designed Apparatus

Test No.	CCl_2F_2—Air Mixture. Per Cent CCl_2F_2 by Volume	Source of Decomposition	Atmosphere in Chamber						
			HF Per Cent by Vol.	HCl Per Cent by Vol.	$COCl_2$ Per Cent by Volume	Cl_2 Per Cent by Volume	CO_2 Per Cent by Vol	CO_2 Per Cent by Vol	CO Per Cent by Volume
1	1.0 (approx.)	Burning Cleaning Fluid	0.44	0.21	Present (Qualitative)	None	.....	.....	.....
2	4.0 (approx.)	Burning Cleaning Fluid	1.07	0.95	Present (Qualitative)	None	.....	.....	.....
3	2.4	Burning Fuel Oil	0.60	0.73	0.170	None	.....	.....	.....
4	7.7	Burning Wood	0.73	1.37	0.064	None	.....	.....	.....
5	1.6	Hot Iron Surface	0.06	0.04	0.000	Less than 0.001	0.1	20.4	Less than 0.1
6	26.0	Hot Iron	0.32	0.36	0.012	0.007	1.0	6.5	Less than 0.1

DECOMPOSITION TESTS IN TEST ROOM

Method

Apparatus

Test Room—The test room is 9 ft. long, 7 ft. wide, and 8 ft. in height made from sheet iron supported on a wooden framework. The interior of the room is coated with an asphaltic base paint. The floor is made from concrete which is coated with wax.

The room is provided with a door 2 ft. 8 in. wide and 6 ft. 8 in. in height. A removable section may be fitted into the lower half of the door frame so as to form an opening 2 ft. 8 in. wide and 3 ft. in height. A glass observation window, 10 in. square, is provided in one of the side walls.

Two illuminating gas burners of the type commonly used in gas ranges and a commercial type of gas range pilot light are mounted at average stove height at the center of one of the 9-ft. side walls. The gas burners and the pilot light are provided with spark gaps so that they may be ignited from the outside of the room by means of sparks produced by an induction coil.

Dichloro-difluoro-methane is admitted to the room at a point 1 ft. above the floor and 1 ft. from each of two converging side walls, one of which is the wall on which the gas burners are mounted. The amount of dichloro-difluoro-methane entering the room is measured by means of a gas meter. An electric fan is placed on the floor of the room so as to produce rapidly a uniform mixture of the refrigerant with the air in the room.

Use of Sampling Tubes

For the purpose of selecting samples of the atmosphere in the room during the tests, an iron sampling tube, 4 ft. in length, is inserted at the center of the side wall opposite the gas burners, the height of tube above the floor being 2 ft. A second glass sampling tube, 2 ft. in length, is inserted in the same wall at a height of 7 ft. from the floor. All parts of the sampling tubes were heavily coated with a wax mixture having a high melting point.

The temperature within the room during the tests is measured by means of iron-constantan thermocouples connected to a potentiometer. The junction of one thermocouple is located between gas burners at a point 6 in. above the burners. The junction of a second thermocouple is located directly above the observation window on the side wall opposite the gas burners at a point 6 ft. above the floor.

Test Procedure

Test No. 7—The test room door was closed and a quantity of dichloro-difluoro-methane corresponding to that which might be liberated by leakage of a small refrigeration unit was introduced into the test room. The electric fan was not operated during this test. A sample of the mixture of dichloro-difluoro-methane and air was withdrawn from the room for analysis 5 min. after the refrigerant was introduced. The method used for the analysis of mixtures of dichloro-difluoro-methane and air has been previously mentioned.

Two gas stove burners were then ignited from the outside of the room. The temperature of the room was recorded at 5-min. intervals. Samples of the atmosphere in the room were selected at the end of 20, 40, and 60 min. after igniting the burners and the percentages of hydrogen chloride and hydrogen fluoride determined from 10 liter samples. At the end of 60 min., samples of the test room atmosphere were also withdrawn and examined for chlorine and phosgene. The percentages of carbon dioxide, oxygen, and carbon monoxide were determined in a sample of the room atmosphere selected at the end of 60 min., the usual Orsat method being used for that purpose.

The test was discontinued at the end of 60 min. after igniting the gas stove burners.

The test room was thoroughly cleaned at the conclusion of the test in order to remove the acid materials which condensed on the walls.

Tests No. 8, 9, and 10

Test No. 8—The test was conducted according to the same procedure described in connection with Test No. 7 except that only one gas stove burner was ignited and the electric fan was operated while the dichloro-difluoro-methane was being introduced into the test room but was not operated after igniting the gas burners.

Test No. 9—The test was conducted according to the same procedure described in connection with Test No. 7 except that the electric fan was operated while the dichloro-difluoro-methane was being introduced into the test room but was not operated after igniting the two gas burners.

Test No. 10—A wire animal cage containing two guinea pigs was suspended inside of the test room at a point 5 ft. above the floor and 1 ft. away from the glass observation window. A similar cage containing two guinea pigs as controls was placed outside of the test room.

The test room door was then closed and dichloro-difluoro-methane introduced into the room ,the electric fan being operated during that period. A sample of the mixture of dichloro-difluoro-methane and air was withdrawn from the room for analysis.

One gas stove burner was then ignited from the outside of the room. The electric fan was not in operation after igniting the gas burner. The temper-

(Continued on Page 11, Column 1)

REFRIGERATION GASES
CARBON DIOXIDE — BUTANE — AMMONIA
ETHYL CHLORIDE—METHYL CHLORIDE
ISOBUTANE—SULPHUR DIOXIDE
30 DIFFERENT Compressed Gases
We refill your cylinders or supply new cylinders
One Pound to Carload Lots
Write for price list
The Matheson Co
East Rutherford, N. J.
Valves Controls and Equipment

Findings of Underwriters' Laboratories

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ature of the room was recorded at 5-min. intervals. The behavior of the guinea pigs throughout the test was observed. Samples of the atmosphere within the room during the test were withdrawn and analyzed according to the procedure previously described in connection with Test No. 7 except that all of the samples were selected at the end of 10 min. after igniting the gas burner.

The test was discontinued at the end of 15 min. after igniting the gas stove burner.

Test No. 11—A wire animal cage containing two guinea pigs was suspended inside of the test room as previously described in connection with Test No. 10, and a similar cage containing two controls was placed outside of the test room. The removable section was then fitted into the lower half of the door frame, so that when the door was open, an opening representing an open window 2 ft. 8 in. by 3 ft. was formed in the upper half of the door frame. This opening communicated directly with the outside atmosphere.

The test room door was then closed and dichloro-difluoro-methane introduced into the room, the electric fan being operated during that period. A sample of the mixture of dichloro-difluoro-methane and air was withdrawn from the room for analysis.

The operation of the electric fan was discontinued and the test room door opened, the removable section being fitted into the lower half of the door frame. One gas stove burner was then ignited from the outside of the room. The temperature of the room was recorded at 5-min. intervals. The behavior of the guinea pigs throughout the test was observed. Samples of the atmosphere within the room were withdrawn and analyzed according to the procedure previously described in connection with Test No. 7.

The test was discontinued at the end of 1 hr. after igniting the gas stove burner.

The guinea pigs exposed to the fumes within the room during the test and the controls were retained at the conclusion of the test for observation.

Test No. 12—A wire animal cage containing two guinea pigs was suspended in the test room as previously described in connection with Test No. 10, and a similar cage containing two controls was placed outside of the test room.

The test room door was then closed and dichloro-difluoro-methane introduced into the room, the electric fan being operated during that period. A sample of the mixture of dichloro-difluoro-methane and air was withdrawn from the room for analysis.

The operation of the electric fan was discontinued and a commercial type of gas range pilot light ignited from the outside of the room. The temperature of the room was recorded at 5-min. intervals. The behavior of the guinea pigs throughout the test was observed.

Samples of the atmosphere within the room were withdrawn at the end of 20 min., 40 min., 1 hr., 1½ hr., 3 hr., and 4 hr. after igniting the pilot light and the percentages of hydrogen chloride and hydrogen fluoride determined. At the end of 4 hr., samples were also withdrawn and the percentages of phosgene, chlorine, carbon dioxide, oxygen, and carbon monoxide determined. The test was discontinued at the end of 4 hr.

Results

Tests Nos. 7, 8, and 9—The analytical results and other data of these tests are given in Table III.

The fumes formed by the decomposition of dichloro-difluoro-methane when in contact with flames such as are produced by ordinary gas range burners were found to contain hydrogen chloride and hydrogen fluoride in all of the tests. The atmosphere in the room during the tests was also found to contain carbon dioxide. The oxygen concentration in the room at the conclusion of the tests was less than that of ordinary air.

Results of tests for phosgene, free chlorine, and carbon monoxide in the fumes were negative.

Test No. 10—The analytical results and other data of this test are given in Table III.

The guinea pigs within the test room showed no evidences of discomfort during the period in which the dichloro-difluoro-methane was being introduced into the room. One minute after igniting one gas stove burner, the guinea pigs showed visible evidences of being affected by dichloro-difluoro-methane decomposition products. They rubbed their noses frequently, coughed, and ran about the cage in an erratic manner. At the end of 4 min., both animals showed a decided increase in both the rate and the depth of their breathing. One of the guinea pigs collapsed on the floor of the cage at the end of 7 min. and apparently died at the end of 9½ min. The second guinea pig collapsed and apparently died at the end of 12½ min. The guinea pigs which were used as controls remained apparently normal for a period of ten days following the test.

Test No. 11—The analytical results and other data of this test are given in Table III.

The guinea pigs within the test room showed no evidences of discomfort during the period in which the dichloro-difluoro-methane was being introduced into the room. One and one-half minutes after igniting one gas stove burner, both guinea pigs were rubbing their noses and coughing. At the end of 5 min., both animals showed a decided increase in the rate and depth of their breathing. At the end of 20 min. both guinea pigs were apparently having difficulty in breathing. They rubbed their noses and were occasionally subject to violent tremors over their entire bodies. At the end of 30 min. the animals were walking slowly around the cage still rubbing their noses and occasionally trembling. At the end of 40 min., the guinea pigs appeared to be recovering from the effects of the fumes, were still breathing rapidly and deeply but were able to move about the cage in a normal manner. The test was discontinued at the end of 1 hr. since the analysis of the atmosphere in the room indicated that the dichloro-difluoro-methane decomposition products had been replaced by fresh air coming through the open window.

Both the guinea pigs which were exposed to the fumes and the controls were held at the conclusion of the test for observation. The animals exposed to the fumes appeared normal 18 hr. after the test and remained normal for at least ten days after the test. The controls appeared normal for at least ten days after the test.

Test No. 12—The analytical results and other data of this test are given in Table III.

The guinea pigs within the test room showed no evidences of discomfort during the period in which the dichloro-difluoro-methane was being introduced into the room. Seven minutes after the igniting of the gas range pilot light, the guinea pigs were rubbing their noses and coughing. At the end of 20 min., they were sitting on the floor of the cage rubbing their noses and breathing rapidly and deeply. They were subject to occasional violent tremors over their entire bodies. The animals showed these same symptoms throughout the remainder of the test, which was discontinued at the end of 4 hr.

One of the guinea pigs died within ½ hr. after the conclusion of the test. The other guinea pig appeared to breath more rapidly and deeply than normally for five days following the test but appeared to be normal at the end of a week after the test.

Record in Service

The product has not been subjected to the test of actual service.

The Submittor

The submittor is Kinetic Chemicals, Inc., DuPont Building, Wilmington, Delaware. The product covered by this report is the first which it has submitted to the Laboratories.

SUPERVISION OF THE PRODUCT BY THE LABORATORIES:

The material will be placed under Reexamination Service.

CONCLUSIONS

Results of the Identification and Anlytical Tests indicate that the product is dichloro-difluoro-methane (CCl_2F_2) of a high degree of purity.

Results of qualitative tests indicate that the product consists of carbon, chlorine, and fluorine in chemical combination.

The density of the sample submitted corresponds to that of dichloro-difluoro-methane.

Fire Hazard

Dichloro-difluoro-methane is a noncombustible and nonflammable refrigerant.

Flammability—Results of Flammability Tests indicate that mixtures of dichloro-difluoro-methane vapor and air do not propagate flame either at ordinary or elevated temperatures upon application of electric sparks or gas flames. (See Table I.)

Ignition — Dichloro-difluoro-methane shows no apparent ignition at temperatures up to 750 C (1328 F) when subjected to apparent ignition temperature tests.

Mixtures of dichloro-difluoro-methane and air are not ignited by application of sparks or flame.

Stability — Dichloro-difluoro-methane is a stable compound capable of undergoing without decomposition the physical changes to which it is commonly subjected in service, such as freezing, boiling, and compression.

Available data indicate that in the absence of moisture, dichloro-difluoro-methane does not corrode iron, steel, aluminum, copper, monel metal, tin, and tin-lead solders, brasses, and phosphor bronzes.

Toxicity

The hazards of health resulting from exposure to dichloro-difluoro-methane when used as a refrigerant are judged to be remote.

Consideration of available data indicates that dichloro-difluoro-methane is in a class with the practically nontoxic gases.

Corrosive Action

Under conditions in which moisture is not present, dichloro-difluoro-methane as made by the manufacturer does not corrode the metals commonly used in the construction of refrigeration systems.

The results of corrosion tests conducted on aluminum, zinc, yellow brass, and phosphor bronze indicate that dichloro-difluoro-methane as made by the manufacturer does not corrode those metals under conditions in which water is not present.

The results of corrosion tests conducted under conditions in which water was present, show that dichloro-difluoro-methane in the presence of water corrodes several common metals. (See Corrosion Tests.)

Decomposition Products

When in contact with common illuminating gas flames, dichloro-difluoro-methane is readily decomposed, yielding hydrogen chloride and hydrogen fluoride. Although concentrations which are dangerous to life may be met with under some conditions which occur in practice, the irritant character of the decomposition products gives definite warning and acts to prevent prolonged exposure.

When burning wood or oil, hot surfaces (550 C) or electric sparks are involved, additional products of decomposition may include small quantities of chlorine and phosgene.

The results of the decomposition tests conducted in the test room with flames produced by ordinary gas range burners and a pilot light show that the decomposition products of dichloro-difluoro-methane include appreciable amounts of hydrogen chloride and hydrogen fluoride. (See Table III for test data including concentrations.)

The results of the decomposition tests conducted in a specially designed apparatus with oil and wood fires show that the decomposition products of dichloro-difluoro-methane include hydrogen chloride, hydrogen fluoride, and phosgene. (See Table II for test data including concentrations.)

The results of tests conducted in a specially designed apparatus with iron surfaces heated to dull red heat (550 C) show that the decomposition products of dichloro-difluoro-methane include hydrogen chloride, hydrogen fluoride, and small quantities of phosgene and free chlorine. (See Table II for test data including concentrations.)

Uniformity

Results of the Identification and Analytical Tests show that dichloro-difluoro-methane as made by the manufacturer is of a high degree of purity. Considering the general process of manufacture, it appears to be practicable to maintain a high standard of uniformity on a commercial scale.

Practicability of Control

Dichloro-difluoro-methane in condition for commercial use is shipped liquefied in steel cylinders under a vapor pressure of about 75 lb. per sq. in. at ordinary temperatures.

Protection of Refrigerating Systems

Refrigerating systems using dichloro-difluoro-methane should be designed and constructed to withstand without leakage or breaks the pressures (with a suitable factor of safety) to which such systems are liable to be subjected in operation, and be provided with adequate safeguards to insure operating and emergency safety.

To prevent possible corrosion, precautions should be taken to prevent the introduction of water into the system.

Recommendation

TO THE FIRE COUNCIL OF UNDERWRITERS' LABORATORIES:

We recommend promulgation of the following notice to subscribers and the action indicated thereby:

Guide No. 540 118

Oct. 10, 1931—Laboratories' File MH2256

Kenetic Chemicals, Inc., Mfr.
Wilmington, Del.
Refrigerant

A refrigerant consisting of dichloro-difluoro-methane of a high degree of purity. It is shipped compressed to a liquid in steel drums under a pressure of about 75 lb. per sq. in. when at 70 F.

Dichloro-difluoro-methane is nonflammable and noncombustible.

Dichloro-difluoro-methane itself is stable, nonirritating and nontoxic, but under fire conditions or where appreciable quanties of dichloro-difluoro-methane come in contact with flame or hot metal surfaces (dull red heat, about 550 C), the decomposition products are corrosive, irritating and toxic when inhaled, but do not burn or form explosive mixtures with air. The irritating character of the decomposition products gives definite warning and acts to prevent prolonged exposure, but where prompt exit is not made particularly from closed rooms, life may be endangered. The decomposition products are readily dissolved by water from automatic sprinklers or hose streams.

Marking: "Kinetic No. 12" on cylinders.

LISTED—FIRE
REEXAMINATION SERVICE.

See description of Reexamination Service on guide card.

TESTS BY:
R. E. DUFOUR
M. PETERSON
REPORT BY:
A. M. NUCKOLLS,
Chemical Engineer
A. F. MATSON,
Associate Chemical Engineer
R. E. DUFOUR,
Assistant Chemical Engineer
REVIEWED BY:
A. M. NUCKOLLS,
Chemical Engineer
Submitted,
A. M. NUCKOLLS,
Chemical Engineer

The foregoing recommendation has been accepted and the action proposed therein has been taken. Nov. 18, 1931.

UNDERWRITERS' LABORATORIES,
D. B. ANDERSON,
Secretary.

TABLE III

Decomposition Tests With Dichloro-Difluoro-Methane Tests Conducted in Room 9 by 7 by 8 Ft. in Size

Test No.	Ventilation	Source of Flame	CCl_2F_2 Air Mix. at Start of Test. Per Cent CCl_2F_2 by Vol.	Time Sampled	Temperature		HF Per Cent by Vol.	HCl Per Cent by Vol.	$COCl_2$ Per Cent by Vol.	Cl_2 Per Cent by Vol.	CO_2 Per Cent by Vol.	O_2 Per Cent by Vol.	CO Per Cent by Vol.
					Room	Near Flame							
7	Door closed	2 gas range burners	2.6	20 min. 40 min. 60 min.	45 C 46 C 46 C	60 C 64 C 64 C	0.026 0.068 0.058	0.012 0.028 0.025	0.00	0.00	3.0	12.4	Less than 0.1
8	Door closed	1 gas range burner	1.8	20 min. 40 min. 60 min.	37 C 37 C 38 C	48 C 54 C 52 C	0.160 0.149 0.130	0.137 0.106 0.087	0.00	0.00	1.2	18.0	Less than 0.1
9	Door closed	2 gas range burners	2.2	20 min. 40 min. 60 min.	66 C 67 C 67 C	77 C 78 C 78 C	0.686 0.469 0.268	0.442 0.373 0.259	0.00	0.00	2.4	16.8	Less than 0.1
10	Door closed	1 gas range burner	3.0	10 min.	42 C	53 C	0.282	0.225	0.00	0.00	1.0	19.8	Less than 0.1
11	Opening 32 by 36 in.	1 gas range burner	2.5	20 min. 40 min. 60 min.	32 C 32 C 32 C	42 C 42 C 42 C	0.003 0.002 Less than 0.001	0.004 0.002 Less than 0.001	0.00	0.00	0.1	20.6	Less than 0.1
12	Door closed	1 gas range pilot light	1.7	20 min. 40 min. 60 min. 1½ hr. 2 hr. 3 hr. 4 hr.	28 C 29 C 29 C 29 C 30 C 31 C 32 C	33 C 34 C 34 C 34 C 34 C 35 C 36 C	0.008 0.006 0.005 0.003 0.004 0.004 0.004	0.013 0.011 0.004 0.006 0.005 0.005 0.005	0.00	0.00	1.0	19.8	Less than 0.1

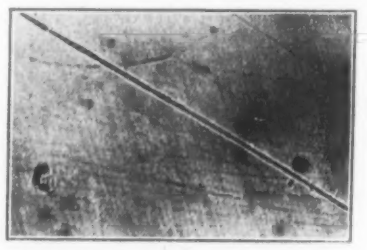
Appendix C

Appendix "C" is a report of investigations of R. R. Sayers, W. P. Yant, John Chornyak, and H. W. Shoaf performed at the Pittsburgh Experiment Station of the U. S. Bureau of Mines of the Department of Commerce. Published as U. S. Bureau of Mines Report of Investigations 3013.

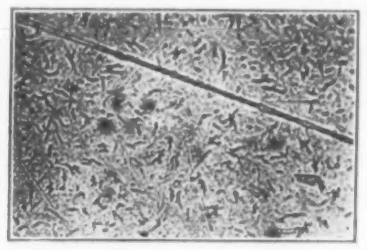
Appendix D—Etching Effect

PHOTOMICROGRAPHS—MAGNIFICATION 300 DIAMETERS

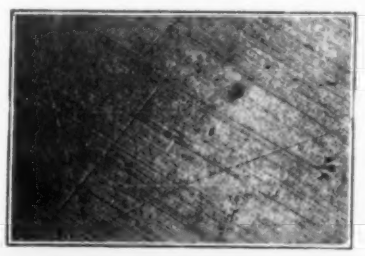
After the tests in the presence of flame were completed, the bullet-proof safety glass in the window in the east wall was examined for evidence of attack by the HF formed during the experiments with Kinetic No. 12. No noticeable etching was visible, but microscopic examination showed that the glass had been attacked. Photomicrographs made of the unexposed side and the exposed side are shown as photomicrographs No. 1 and No. 2. For comparison, photomicrographs No. 3 and No. 4, showing additional experiments on bullet-proof safety glass, are included.



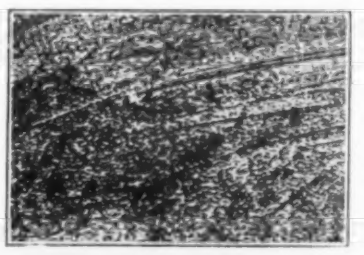
No. 1—Unexposed side of bullet-proof safety glass removed from the observation window after the flame tests.



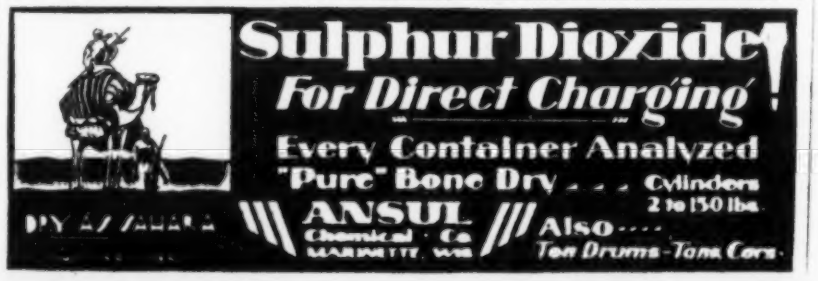
No. 2—Exposed side of bullet-proof safety glass and extent of etching resulting from HF during the tests.



No. 3—Etching resulting from 30 minutes exposure to 1 per cent HF solution.



No. 4—Etching resulting from 5 minutes exposure to .1 volume dry HF vapor.



Baer Stresses Importance of Safety in Design

Problems Interwoven With Refrigerator Manufacture, A.S.R.E. Head Finds

By A. H. Baer*
President, American Society of Refrigerating Engineers

SAFETY problems included within the scope of this paper are so interwoven with problems of *safety in manufacture* and *safety in operation* that it is rather difficult to keep them separated. I have therefore concluded that it should cover to some extent *safety in manufacture*, for the design of refrigerating equipment is in nearly every case accomplished by those who are engaged in its manufacture.

While working on the subject, I found it growing so much that I am now quite certain that this discussion will not completely cover any of its phases. In fact, I believe that if it was divided into several parts entitled "safety in design," "safety in manufacture" and "safety in installation," each would warrant the time that we will be able to devote to all three.

First, we ought to consider the meaning of the word "safety" as it is used here. I understand that it will mean "reasonable safety to life, limb, health, and property."

American Safety Code

Refrigerating engineers know that an American standard safety code for mechanical refrigeration was recently approved and recommended for adoption. It would seem to be sufficient for me to submit a discussion of this code for it is intended to indicate to everyone interested in the use of refrigerating equipment what is reasonably safe.

However, a code can only state requirements and limits; it cannot include an explanation of the reasons for these requirements. I will therefore first discuss what I believe to be the outstanding hazards or risks that should be safeguarded, and will then submit the code itself.

Turning first to the designer, who, by the way, usually goes his way with praises unsung, we should consider that he is the one who is to make most of the major decisions which determine the degree of safety that any piece of equipment will possess.

Hazard, Efficiency of Refrigerants

He will select the refrigerant, taking into account the hazards as well as the efficiency that different refrigerants show. He also must decide how the refrigerants shall be handled; how strong the various parts of the equipment shall be and what safeguards or safety devices are incorporated into the design.

Those familiar with the engineering side of refrigeration know that refrigerants possess widely different characteristics; one may be liquefied under a high pressure and may do its cooling under relatively high pressures requiring heavy apparatus and yet it may have other characteristics very desirable.

Another may be liquefied at relatively low pressure and perhaps do its cooling at or below atmospheric pressure but may possess other characteristics that become serious hazards.

Suitability of Refrigerant

The designer must first consider which refrigerant will be most suitable from the standpoint of efficient refrigeration, and if that one may be reasonably safeguarded he will probably select it; otherwise, he will select the one next best to be reasonably safe for the use intended.

The manner in which the refrigerant is circulated and controlled in its functions will have a great deal to do with the safety conditions surrounding its use. In one case it may be so handled that nearly all of the working liquid refrigerant supply is carried in the evaporator or low pressure side of the plant.

In another case the evaporator may contain mostly vapor and gas, the liquid supply being held in a reserve receiver or in the bottom of the condenser.

Again, the liquid may be admitted to the evaporator by means of electrically controlled valves or by automatic expansion valves (pressure control) or by float controlled valves.

The flow of the gas and vapor from the evaporator, after it has performed its cooling work, may in some cases be allowed to carry slugs of liquid which become dangerous if they enter a rapidly moving compressor. These, on the other hand, may be properly controlled, separated and kept away from the compressor.

The strength of parts which the designer will select, will, in most cases, require very little of our attention for the reason that this is mainly a question of machine design practice and the practice in that branch of design work has been so well established that we can add little to it here. There are, however, other parts of the plant where the designer will have to use his judgment and will have only a limited degree of established practice to follow. This will mostly be in the lowside equipment.

The type of safeguards and safety devices which the designer selects brings us to the heart of this subject. To consider these properly, I want to take up in the order that I see them the outstanding hazards which may occur with the operation of any piece of refrigerating equipment or in any refrigerating plant after it is assembled and installed.

The word "hazard" in this case may be assumed to mean the "risk of injury to people and property that attends the use of refrigerating equipment."

Safety In Construction

Among other things, the hazards growing out of the characteristics of the refrigerant itself are the chief ones. For example, the effect of escaping refrigerant on human lives, or on the products being cooled, are paramount things to consider. The hazard due to fire and the ease or difficulty with which the refrigerant may be controlled come next. These hazards may be divided into three general groups.

1. Those inherent with the equipment.

2. Those connected with the operation of the equipment.

3. Those due to sources outside the equipment and its operators.

In the first class are hidden defects in castings, errors in the physical composition of metals, hidden defects in the walls of pipes and joints, imperfectly riveted and welded seams, improperly proportioned parts.

In the second group we may list overheated compressors, excess pressure, temperature strains, damaged gaskets, stuffing box damage, vibration damage, imperfect foundation base, frozen pipes and tubes, unstable supports, hydraulic hammer.

The third group will include unsafe machinery nearby, sinking foundations, failing supports, weather damage, flood water damage at low floor levels, falling roofs or building walls, storm damage, fire damage.

It will be recognized that some of these hazards may be safeguarded by the designer and some will call for watchfulness on the part of the erector and operator, while the remainder are elements beyond the control of either but may be safeguarded to some extent.

In order to discuss them more in detail I want to classify them in a different manner, and to mention such safeguards as are generally known.

The safeguards should, of course, be understood, and I will refer to these first. Some of them will be used quite frequently, in fact every plant will require them, others come into use only for certain cases.

Series of Tests

Hydraulic Test. This is a test accomplished by pumping a hydraulic pressure on compressor cylinders, pressure vessels and any other parts that may be subject to pressure. It is used to determine the strength of the part and will sometimes be applied until the part fails in order to determine the ultimate breaking strain of a particular design or to check the designer's figures.

Air Test. This is a test accomplished by pumping an air pressure on compressor cylinders, pressure vessels and all other equipment that will contain refrigerant when placed in the plant. It may be employed to test the strength but only with substantial screens or guards around it to protect workmen in case of breaks.

It is usually used to determine tightness against leak. When thus used the part being tested will be submerged under water or if this cannot be done the outer surface of the part where leak may occur will be brushed with a liquid substance that would disclose the smallest bubble of air escaping through a leak.

Dry Out Test. This consists in baking the parts when partly assembled or after complete assembly to insure that they are completely dry inside before the refrigerant is introduced. It is useful when refrigerants are used that will combine with water to form other substances that are troublesome.

Chemical Analysis. This is a test used chiefly by the manufacturer to determine whether the materials that have been used in the manufacture of equipment agree with the specifications. The physical composition of the metal being known, its suitability for the purpose will be easily determined from well tested available data.

Tensile Test. This is a test also used to determine the suitability of the materials used as to strength. It will be applied generally to materials used in equipment and chiefly by the designer and the manufacturer. With this we may also class the bending test which is applied by clamping a strip of the material in such a manner that it may be repeatedly bent back and forth to determine its resistance.

Inspection Test

Inspection Test. This will be applied both during the manufacture and after the equipment is installed. It comprises a very close check of both materials and finished equipment according to well tried rules. It will disclose many defects before the other tests are applied.

Relief Valves. This is a pressure relief valve having adjustable spring tension and is attached to compressor cylinders and other pressure vessels where excess pressure may occur. It will act as a safety valve to relieve excess pressure at a predetermined point.

H. P. Cut-out. This is a device attached to a high pressure gauge or having facilities within itself for attachment to pipe lines connecting to pressure vessels and compressor cylinders. It will have parts suitable for electric wire connection to motor starters, magnetic valves, etc., and will respond to pressure by opening the motor circuit and stopping machinery before excess pressure occurs.

Water Failure Switch

Water Failure Switch. This is a device that acts somewhat like the H. P. cut-out with the difference that it will function in a reverse manner to operate motor starters, magnetic valves, etc, and stop compressors, pumps, or other equipment when the water supply fails or its pressure becomes very much reduced.

B. P. Control. This is a device that controls the back pressure at which the plant may operate. It is placed in the refrigerant suction line to the compressor and when the back pressure has been reduced to its setting it will act to prevent the compressor from taking further gas sufficient to reduce this pressure further.

It is used where the temperature level in the evaporator must not go below a certain fixed point on the thermometer or where there is danger of freezing liquids inside of the pipes and rupturing them.

Engine Stop Device

Engine Stop. This is a device or combination of them that will automatically shut off fuel or steam to internal combustion engines and steam engines when excess pressure occurs or temperature levels go beyond pre-determined points. It may be a magnetic valve placed in the supply line to the engine operated by H. P. cut-out, water failure switch, thermostat, etc.

Remote Switch. This is an emergency switch in the main feed wires to the plant that is located outside the engine room and preferably near an outer door or window where it may be reached from the outside in case of a sudden accident occurring in the plant accompanied by rapid escape of the refrigerant, or in case of fire. This switch may be located within the engine room and one or more remote controls for it located outside as stated.

Fire Department Control. This comprises a pipe line from the main parts of the refrigerating system to a point outside the building having a special valve in this pipe locked and under the control of the fire department of the city or town.

The outlet from the valve will be led to a diffuser placed above the roof of the building and away from surrounding buildings or into a water mixer having its outlet leading to the sewer or the pipe will be led into a tank of water.

The fire department is thus enabled to release the refrigerant from the entire plant before entering when the extent of the fire renders this advisable.

Motor Stall. This comprises a rule or method for designing compressors and applying motors for driving them in a manner that the motor will become overloaded and stall before sufficient excess pressure occurs in the compressor and the refrigerating equipment to burst either of them.

This is applied chiefly with small machine sizes where the use of such excess strength does not create unusually heavy compressor walls and equipment parts.

Let us now turn to a further discussion of the hazards against which safeguards need be planned and classify them for detailed consideration as previously mentioned.

Unequal casting walls in compressors are sometimes a serious hazard. They occur when the core becomes shifted before or during the pouring of the casting in the foundry. They are difficult to locate as there is no outside indication of this occurrence.

Unequal thickness may be noted when it occurs near openings, but if it exists only in the interior of the casting, it will be missed. The safety precaution employed against this occurrence is the hydraulic test. Under this the thin wall will be ruptured and the unsafe casting rejected.

Incorrect physical composition of the metal used in castings is also a hazard but not so serious as some others. It will occur due to wrong information in the enginering department or to mistakes in the delivery of the raw materials.

The result will be chiefly a lack of sufficient strength or of other properties of the metal. Safeguards against this are the hydraulic test or chemical analysis.

Excessive Heat

Overheated compressors will occur due to lack of lubrication, failure of water circulation, resulting in excess pressure, rough surface of walls or too close fitting.

The result may be vaporized oil with excessive pressure which exaggerates the trouble or scored cylinders which is followed sometimes by pistons sticking in the cylinder.

Safeguards against damage due to failure of water are relief valves and water failure switches. The other occurrences are met usually by close observation and check up on the part of erectors and operators.

Closed stop valves are a hazard that may occur in any plant. Men will start the compressor, believing the stop valves are open, or forgetting to investigate this. The result, of course, will sometimes be a bursted compressor attended by serious danger to employes and equipment. The safeguard against this is the relief valve and the H. P. cut-out.

Results of Water Failure

Water failure will occur through the breaking of supply pipes, the failure of electric current driving the pump, the bursting of the main supply, etc. The result will be excess pressure and the chance of bursting compressors, softening gaskets and strained joints with a hazard equal in all respects to that of closed stop valves. The safeguards are the relief valve, H. P. cut-out and water failure switch.

Metal destruction will occur when refrigerants that are otherwise desirable come into contact with water even though it be the small quantity contained in the air. Destructive acids are formed that slowly destroy the metals of compressors or other parts, thus releasing refrigerant when least expected. The principal safeguard is the Dry Out Test.

May Cause Excess Pressure

Defective seams and connections may occur in the manufacture of condensers, receivers and other pressure vessels. The defect may not be visible on the surface, yet when equipment is first subjected to working pressure it will result in a failure that may become a serious hazard.

The safeguard is the hydraulic test which will prove out inferior strength and the air test which will prove out leaks.

Excess pressures will occur in a condenser, receiver or any part of the high side when water supply fails, when equipment is started with valves closed, and sometimes from other causes. The proper safeguard against damage in such case is the relief valve, H. P. cut-out and the water failure switch.

Expansion strain will occur in pressure vessels if they are allowed to fill up with liquid refrigerant and the plant then shut down with the stop valves closed.

In such cases the gradual warming of water, brine or other substances that was being cooled or continues to flow, will create an excess pressure that may burst the vessel. The safeguard for this is the relief valve.

Frozen tubes and pipes may occur when filled with water or other liquids if flow is interrupted or temperature of refrigerant is too low. This can occur in a condenser when pumping out. It will occur in a liquid cooler when the refrigerant temperature is carried too low or when the circulation stops. It can occur in a brine cooler if the refrigerant temperature is low or the brine solution too weak or the circulation stops. The safeguard for this is the water failure switch for the circulating line and B. P. control on the compressor suction.

Joints where pipes connect to pressure vessels and the joints between pipe lengths in a line may sometimes become hazards. Usually these defects will be detected when the air test is applied and the hydraulic test will prove the strength further when extreme measures are warranted.

Expansion and contraction to an unusual extent may fracture a pipe joint without notice. We can guard against it in most cases by avoiding long, straight pipe runs without a bend or change of direction. When threaded joints are used, this safeguard is of greatest importance.

Supports for pipe lines are more important than many suppose. First, to be safe, they must be of sufficient strength to carry five times the weight loaded on them in the case of smaller sizes and up to 10 times such weight in the case of larger sizes.

Second, the supports for large pipes ought to be adjustable vertically to avoid unequal strain and permit proper leveling. Third, for long pipe runs the support should permit sliding of the pipe when wide changes of temperature occur.

Pipe lines should not be bound tightly to a building column or other immovable support except when the intent is to anchor them lengthwise.

Use of Secure Supports

Vibration in pipe lines may result in ultimate fracture of a joint, the loosening of flanges and threads and the ultimate failure of supports. One safeguard against this is the use of secure supports. Another is the correction of the cause, if possible. When the vibration starts with vibrating machinery, the cause may be found in the bases or foundations.

Electric motors and other electrical equipment ought to be located above basement levels when flooring of such levels is possible.

It is well for us to consider that two classes of designers are usually concerned with the production of a refrigerating plant. One is the machine designer, the other the plant engineer.

The former will be experienced in the designing of machinery and equipment, and the various shop methods used in its manufacture. He will know much of the shop men's problems, as well as of the manufacturing facilities of the particular shop where he is located.

The latter will usually be experienced with the theory and practice of refrigeration, the characteristics of refrigerants, the behavior of both the refrigerant and the refrigerating process that is to be used for applying the cooling effect to products or places.

He will generally have considerable experience with the installation of equipment. Neither of these men, however, can accomplish more in connection with the production of a complete plant than to exercise care and give thoughtful study to the safety precautions that should be employed.

Therefore, there must be cooperation of others to secure the full degree of safety in the operation of any plant.

We may now give attention to the American Standard Safety Code for Mechanical Refrigeration.

Make Code Uniform Practice

This code ought to be made the uniform practice with all manufacturers of equipment, and with all city or state authorities who are concerned with the adoption of codes or regulations applying to refrigerating plants.

It, in truth, constitutes a summary or cross section of the opinion of all those actively engaged in the refrigerating field as to what should be set up as safe regulations for this field.

The committee on this code included more than 40 individual representatives of more than 25 engineering societies, trade associations, and other recognized authorities.

Every viewpoint from the machine designer to the final inspection authority having the approval of plant installations for the public was thus represented, and it would in any such case be necessary for much discussion and considerable lapse of time before differing viewpoints could be understood and reconciled.

Covers All Viewpoints

No uniform regulations had previously been advanced in such complete form. This code represents a cross section viewpoint of almost 100 per cent of this committee.

The project was sponsored by the American Society of Refrigerating Engineers and when the final draft was finished, it was submitted to the society for formal approval and then submitted to the American Standards association where it has also been approved.

The committee had during the period of development followed the standard plan of procedure adopted by the American Standards association for such matters.

The procedure under which the work has been done provides for review and revision at certain times so that improved equipment and new methods developed in the refrigerating field may be properly recognized by future modifications.

The code rightfully takes first place in any safety discussion, and those who have not previously studied it should do so at their earliest convenience, and apply its provisions in their business so far as safety measures are found necessary.

*Paper presented before Refrigeration Section of National Safety Council.

B-K, Carrier Air Conditioning System Being Installed On Ocean Liner

(Concluded from Page 1, Column 5)

that passenger liners of the immediate future will be air conditioned throughout, including public rooms and staterooms.

"It is a logical development in travel comfort," Sydney B. Carpender, Brunswick-Kroeschell vice president, says, "and should not materially increase the cost of ship construction. The method of air distribution is not greatly different from the ventilation duct work now employed on the modern liner."

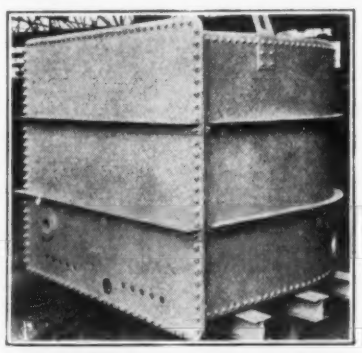
The decision to install an air conditioning system was not made by the owners until the plans of the Mariposa had been completed. The problem presented to the air conditioning engineers, therefore, was of installing all the necessary equipment with the least violence to the already finished plans.

Air Entrance in Ceiling

The method of air distribution in the system of ventilation which had been included in the original designs of the ship, provided for the entrance of the air from the clearstory and ceiling of the dining salon, the exhaust being effected through grilles located near the deck in the side walls. This method of air distribution lends itself well to air conditioning and it was necessary, therefore, only to find a convenient location for the air conditioner and to connect this with the original ventilating system, making some minor alterations in the duct system, according to Brunswick-Kroeschell engineers.

One of the alterations comprised a collecting duct running behind the exhaust openings to provide for the return and recirculation of the conditioned air, thereby decreasing the amount of refrigeration required for the system.

It was necessary to find space for the air conditioning plant in the ship. This was arranged on the deck below, somewhat forward of the dining salon, and by careful layout it was found possible to carry the supply and return ducts through the boiler room with branches extending port and starboard through the engineer's stores and refrigerating



Carbon dioxide marine evaporator

rooms, then up through the deck into the crew's passage on each side of the dining salon, where they connect with the original supply system, and with the collecting duct extending along the crew's passage. The ducts thus exposed to the heat of the boiler room were made of steel plate insulated with 3 in. of corkboard, and the whole encased in heavy canvas.

The supply of fresh (primary) air is obtained from the boat deck. A duct carries this fresh air down between the inner and outer stack casings, and here again the ducts exposed to excessive heat are well insulated to eliminate unnecessary heat gains and to insure operating efficiency, the engineers explained.

Passed Through Water Spray

In operation, the air is cooled by being passed through a spray of refrigerated water. In the cooling process, the air drops part of its moisture, thus lowering its humidity.

The apparatus consists essentially of a cooling chamber in which are a series of cooling coils and atomizers, baffles, and other parts so arranged that the air is brought into intimate contact with the atomized cooled water.

To achieve the necessary dehumidifying requires cooling the air considerably below comfortable temperature, so after leaving the refrigerated spray the air is warmed up to the proper temperature for comfort before entering the circulating ducts by mixing it with recirculated air from the dining salon.

The equipment installed on the Mariposa comprises a Silentvane fan with direct connected variable speed motor, dehumidifier, spray chamber, using direct expansion CO_2 cooling coils, heater batteries, and automatic dampers.

Cooled in Central Plant

The fan draws the air, after it has been conditioned, from the dehumidifier through the heater and dampers, delivering it to the duct system. The outlets of this are concealed behind grilles in the clearstory and ceiling. Special deflectors to insure horizontal diffusion are concealed behind the grilles.

The water of the spray in the air conditioner is cooled by the ship's central refrigerating plant, which also was furnished by the Brunswick-Kroeschell Co. This central plant comprises four units, with enough excess capacity so that it was not necessary to install additional refrigerating equipment for the exclusive use of the air conditioner.

Thermostats are connected to the air dampers and special valves on the heater batteries to maintain proper humidity and temperature of the air, regardless of the number of people in the dining room.

The dining salon on the Mariposa is 116 ft. long, 60 ft. wide, and 8 ft. 9 in. high, with a balcony running about half the length of the room. It will seat 475 passengers at one time.

16,000 Cu. Ft. Per Minute

The air conditioning system has a capacity of 16,000 cu. ft. of conditioned air per minute, of which from 4,000 to 8,000 cu. ft. is primary air, the remainder coming from the recirculating ducts. A complete change of air takes place every four and a half minutes.

"In general, the air conditioning unit on this and other steamships is of the same sort as that used in theaters and in the Capitol at Washington," Mr. Carpender says, "the main difference being in the greater compactness made necessary by available space on shipboard. The collecting tank also must be specially designed to prevent splashing and overflow of water as the vessel rolls or pitches."

Each of the four refrigerating units, into which the plant is divided, is complete in itself, with the four interconnected for flexibility in use. Each group consists of a compressor, condenser, and evaporator or brine cooler. Carbon dioxide is the refrigerant used. The refrigerating capacity of the compressors is 122 tons by the standard A. S. R. E. rating.

Shell, Coil Type Compressors

Condensers are of the shell and coil type, the refrigerant being contained in the coil and sea water being circulated through the shell. There are two condenser pumps, each pump having a capacity of approximately 400 gallons per minute.

The brine coolers are similar in design to the condensers, brine being circulated through the shell and the refrigerant expanding through the coils in the coolers. The brine is circulated by three pumps having a total capacity of more than 24,000 gallons per hour, a fourth pump being kept in reserve.

The brine circulation is divided into two systems, one "high temperature," the other "low temperature." Since much of the refrigerating duty is at relatively high temperatures, this division of the system permits operating one or more of the compressors at relatively high pressure and thereby increases capacity per horsepower input, Brunswick-Kroeschell engineers claim.

Because of the complete flexibility of the plant, any one group of apparatus can be used for cooling either high or low temperature brine, and the circulating system is so valved and connected that any compartment may be operated on the high or low temperature system, depending on the type of cargo in that compartment on the particular trip.

Holds Cooled by Indirect Method

The cargo holds are cooled by the indirect method. Air is passed over a series of coils, through which the chilled brine circulates, and is evenly distributed throughout each hold by means of fans, ducts, and openings.

The ship's stores refrigerators are cooled by exposed coils through which the low temperature brine is circulated.

The cooled cargo space on the Mariposa consists of six separate compartments having a total capacity of 39,000 cu. ft. with cooling surface so designed and arranged that temperatures from 8 to 50° F. may be maintained in each compartment separately, according to requirements.

The ship's stores refrigerators consist of nine compartments, containing a total of 14,500 cu. ft. of storage space, arranged for temperatures varying from 8 to 38° F. The products stores are divided into eight groups: meat, poultry, eggs, butter, vegetables, fish, ice cream, and ice. There are 15 miscellaneous service refrigerators containing a total space of approximately 1,400 cu. ft., maintained at an average temperature of 40 to 45° F.

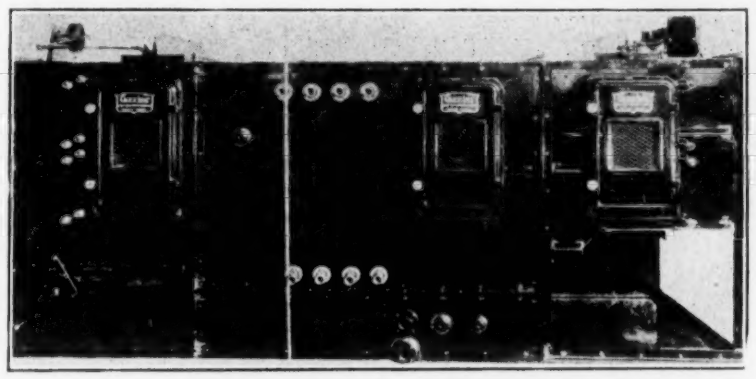
A water cooling tank, containing a cooling coil operating by means of chilled brine from the central refrigerating system, provides a constant supply of ice water for the entire vessel. The water is circulated from the cooling tank by means of a pump.

An ice tank with a capacity of 1,500 lbs. of ice every 24 hours, is also a part of the refrigerating system.

GREEN DIRECTS ENAMELING AT ILLINOIS PLANT

MORRISON, Ill.—George Green, porcelain enameling technician with experience at Kelvinator, Seeger, and Grigsby-Grunow, has been placed in charge of the porcelain department of the Illinois Refrigerator Co., here. Mr. Green is devoting much of his time to modernizing the porcelain plant.

Cooling Sea Air for Travelers



Carrier air conditioning unit which will provide summer comfort in the dining room of the steamship Mariposa.

Sawyer Engineering Develops New Cooling Unit For Domestic, Commercial Work

(Concluded from Page 1, Column 5)

estimated capacity is 500, 850, and 1,200 M. I. E., on the three sizes, and all common refrigerants except ammonia can be used on present models.

The automatic frost control claimed for the Humidi-Cooler is made possible by the action of the fan, which usually removes all frost within five minutes after the compressor stops. Thus, defrosting is taken care of automatically at frequent intervals, Mr. Sawyer pointed out.

"The refrigerated food products will not dry out materially. Beef, for instance, is about 75 per cent water. Thus, 75 per cent relative humidity in a constantly circulated air will not have a tendency to disturb that water content," he claims.

It is estimated that three sizes of coils will take care of many refrigeration needs in the small unit field, and the concern is proceeding on that basis. Mr. Sawyer reported that production had already begun on the new models.

IOWA DEALER INCORPORATES

COUNCIL BLUFFS, Iowa—Articles of incorporation have been filed with the county recorder by the firm of Trindle and Overgaard, Inc., capitalized at $15,000 and authorized to do business at Neola, Iowa, in electrical equipment lines, refrigerators, radios, washing machines, furnaces, heaters and other lines. H. J. Overgaard is president and A. D. Trindle, secretary and treasurer.

SOLID CO_2, ALCOHOL USED FOR FREEZING

LOS ANGELES—For experimental quick-freezing of apricots, peaches, berries, pears, plums, and prunes, a liquid-contact freezer using alcohol and solid CO_2 has been set up in the Richmond-Chase cannery, here, by engineers of the food research division of the U. S. Department of Agriculture.

Although the equipment has little application for commercial production, in the opinion of D. G. Sorber, junior chemist of the division, he points out that it is very practical for experimental purposes.

Open Galvanized Iron Tank

The apparatus consist of an open, galvanized iron tank of about 12-gal. capacity, with a heavy, tight-fitting cover and surrounded by a heavy thickness of insulation.

"Between the tank and the insulation is sufficient space to pack 1-in. slabs of solid CO_2 on all four sides and underneath," Mr. Sorber says. In addition, a 3-in. bunker for the refrigerant divides the tank into two equal compartments.

Circulated by Rotary Pump

The freezing solution, denatured alcohol, is circulated by a small rotary pump installed in the insulation at one end of the box. It is drawn across the bottom of the tank underneath a false bottom, and expelled with some force near the surface at the opposite end, he explains.

Six No. 10 cans, or more smaller ones, can be immersed in the bath at one time. Trays were built to support round paraffined cartons up to the surface of the contents in the bath. A long-stemmed thermometer is placed in a well connected with the circulatory system, projecting above the box so as to be read easily.

A new bulletin on small motors just off the press - - -

ASK FOR A COPY — NO OBLIGATIONS

Everyone who buys, uses, specifies, sells, installs, maintains and repairs small motors will find Wagner's new bulletin on small motors full of interesting and helpful information. It is in loose-leaf form so that it can be kept up to the minute at all times.

At the present time the bulletin consists of thirty pages —22 on single-phase repulsion-start-induction motors, and 8 on single-phase split-phase motors. Additional pages on polyphase squirrel-cage, single-phase condenser, and direct-current motors will be available in the near future.

Ask for a copy of this new bulletin. Place your name on a special mailing list to receive the additional pages as soon as they are printed. Just sign and mail the coupon. You do not obligate yourself in any way.

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Door and Frame Insulating Strips. Gliders for Refrigerator Legs. Top Hole Sections, Lid Collars, Sleeves, Brine Hole stoppers for Ice Cream Cabinets, etc. Specializing in Parts Made to Customer's Design.
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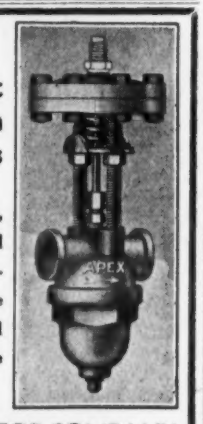


APEX REGULATOR COMPANY
DIVISION OF
FISHER GOVERNOR COMPANY
MARSHALLTOWN, IOWA

Review of Latest Patents Issued in

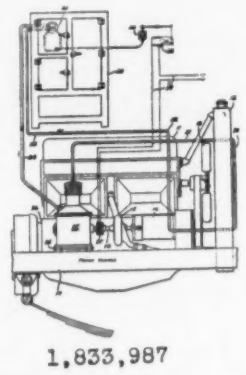
ISSUED DECEMBER 1

(*Continued from Dec. 16 Issue*)

1,833,935. REFRIGERATING APPARATUS. Granville S. Dickey, Dayton, Ohio, assignor to Frigidaire Corporation, Dayton, Ohio, a Corporation of Delaware. Filed Feb. 25, 1928. Serial No. 257,071. 2 Claims. (Cl. 211—153.)

2. A shelf for refrigerators comprising a frame extending around the outer edges of the shelf, two sets of rods arranged transversely to one another and carried by said frame member, all of the rods of one of said sets being straight and lying in the same plane and extending longitudinally in the same direction to provide a surface for articles adapted to be supported and slid longitudinally thereon along the length of said straight rods, the rods of said other set being transverse to said set of straight longitudinally disposed rods and being bent around the underside of said longitudinal straight rods so that the upper surfaces of the transverse rods lying between adjacent longitudinal rods are in the same plane as the upper surfaces of said longitudinal straight rods and forming therewith a plane surface adapted for the support and ready sliding of objects thereon in the direction of said longitudinal straight rods.

1,833,987. REFRIGERATING APPARATUS. William A. Chryst, Dayton, Ohio, assignor, by mesne assignments, to Frigidaire Corporation, a Corporation of Delaware. Filed Nov. 20, 1926. Serial No. 149,770. 5 Claims. (Cl. 62—117.)



1,833,987

5. In combination, a vehicle, an internal combustion engine mounted on said vehicle drivingly connected to said vehicle, said engine including a water cooling system having a radiator and fan at the front of said vehicle, a refrigerant compressor on said vehicle, a magnetically controlled clutch drive between said engine and said compressor, means confining a space to be refrigerated on said vehicle, a refrigerant evaporator in said space discharging to said compressor, a refrigerant condenser on said vehicle adjacent said radiator and fan and cooled by air currents induced by said fan and receiving refrigerant from said compressor and delivering the same to the evaporator, means responsive to refrigeration conditions in said space controlling electrical energy for said magnetic clutch drive.

1,834,009. REFRIGERATING SYSTEM. James A. Tillinghast, Providence, R. I. Filed Feb. 23, 1928. Serial No. 256,382. 4 Claims. (Cl. 62—95.)

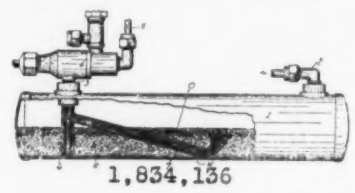
1. A refrigeration device of the character described comprising a refrigerator conduit in combination with means for preventing excess refrigeration in the space to be cooled, said means consisting of a chamber through which said conduit extends, means providing an insulating jacket of ice filling said chamber and enclosing said conduit, and expansion means within the chamber to compensate for expansion therein during the formation of said ice jacket.

1,834,038. REFRIGERATING APPARATUS. Otto M. Summers, Dayton, Ohio, assignor to Frigidaire Corporation, Dayton, Ohio, a Corporation of Delaware. Filed Dec. 31, 1929. Serial No. 417,704. 7 Claims. (Cl. 251—119.)

2. In combination a discharge valve for a refrigerating compressor including a valve plate provided with one or more openings, a valve reed cooperating with said plate and adapted to close said opening or openings, said plate and reed extending outwardly beyond and being secured together outwardly beyond the walls of said compressor, the periphery of said plate being provided with heat dissipating means.

4. In combination a valve provided with a plurality of annular ridges, a plurality of openings in said plate between said ridges, a valve reed cooperating with said valve plate and resting on said ridges, said reed being provided with an opening separated from the openings in said plate by one of said ridges, a spacer between the reed and the plate and means provided in the other of said ridges for allowing the escape of any gases trapped between the spacer and said reed or said plate.

1,834,136. MEANS FOR LUBRICATING REFRIGERATION SYSTEMS. Frank W. Andrews, Fort Wayne, Ind., assignor, by mesne assignments, to Apex Electric Manufacturing Company, Cleveland, Ohio, a Corporation of Ohio. Filed Mar. 19, 1928. Serial No. 262,815. 11 Claims. (Cl. 62—115.)



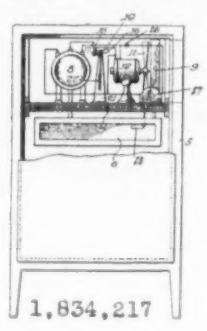
1,834,136

1. In a refrigeration system through which lubricant is circulated with refrigerant; a liquid receiver, an outlet tube from an upper part of said receiver extending downwardly and terminating in said receiver below the normal level of liquid therein, and wick means for conveying lubricant in said receiver into said tube, said tube connected into the next point of the system through which refrigerant normally passes in the cycle of its circulation.

1,834,137. CAPILLARY MEANS FOR FORWARDING LUBRICANT FROM THE EVAPORATOR OF REFRIGERATING SYSTEMS. Frank W. Andrews, Fort Wayne, Ind., assignor, by mesne assignments, to Apex Electrical Manufacturing Company, Cleveland, Ohio, a Corporation of Ohio. Filed May 21, 1928. Serial No. 279,253. 2 Claims. (Cl. 62—115.)

1. In combination with the evaporator of a refrigeration system of the flooded type through which lubricant is circulated with refrigerant, an outlet above the liquid level in said evaporator, and a wick extending from a place contiguous to said outlet and in the path of gaseous refrigerant normally flowing therethrough downwardly into the body of accumulated lubricant.

1,834,217. SWITCH. Carl E. Lipman, Beloit, Wis., assignor to Lipman Patents Corporation, Chicago, Ill., a Corporation of Delaware. Filed Oct. 7, 1927. Serial No. 224,570. 3 Claims. (Cl. 62—4.)



1,834,217

1. In a refrigerating system the combination of a compressor and a motor for driving the same inclosed together within a sealed housing, the motor being provided with a normal running winding and an auxiliary starting winding, a fluid contact switch in a sealed tiltable casing for opening and closing the circuit to said starting winding, a second electric motor and a fan driven thereby positioned to blow air onto the exterior of said housing for cooling the same, the circuit controlling the operation of the fan motor being in parallel with the circuit controlling the starting and stopping of the compressor motor, and a vane constructed to be moved by the air propelled by said fan to tilt the contact switch to open the circuit of the starting winding and upon the stopping of the fan to restore the contact switch to closed contact position.

1,834,459. FREEZING UNIT. John G. Lapham, New York, N. Y. Filed Jan 30, 1929. Serial No. 336,095. Renewed May 4, 1931. 5 Claims. (Cl. 62—101.)

1. In a freezing unit the combination of an outer shell and an inner shell, having chambers between them and said inner shell having a freezing chamber therein, pipes having openings extending through a pair of the walls of the outer shell and means to form a tight joint between said pipes and said walls of the outer shell when said pipes are perpendicular to said walls and when deviating from a right angle thereto.

1,834,736. METHOD OF ATTACHING FINS TO CYLINDERS. Lewis J. Purdy, Syracuse, N. Y., assignor, by mesne assignments, to Franklin Development Corporation, Syracuse, N. Y., a Corporation of New York. Filed Feb. 28, 1929. Serial No. 343,468. 4 Claims. (Cl. 219—12.)

1. The process of attaching fins having a greater heat conductivity than cast iron to cast iron cylinders consisting in interposing a strip of solder consisting predominately of silver between the angular base flanges on the fins and the cylinder wall and arc welding the same together, the flange of each fin with its strip of silver solder overlying the strip of alloy formed by the excess solder of the preceding strip and the cylinder wall along the base flange of the preceding strip and being welded to the cylinder wall through such excess solder from the welding operation of the preceding fin.

1,834,873. REFRIGERATOR PLANT. Eric George Rowledge, New Eltham, London, England, assignor to J. Stone & Company, Limited, Deptford, England, a Corporation of Great Britain. Filed May 19, 1930. Serial No. 453,825, and in Great Britain June 19, 1929. 3 Claims. (Cl. 62—115.)

1. Refrigerating plant comprising a compressor, a condenser, an evaporator consisting of a plurality of evaporator elements at a higher level than said compressor, a load demand valve controlling the supply of refrigerant and a trap-vessel connected between two of said evaporator elements and capable of containing at least the total charge of liquid refrigerant.

ISSUED DECEMBER 8

1,834,949. REFRIGERATING APPARATUS. Harry B. Hull, Dayton, Ohio, assignor to Frigidaire Corp., Dayton, Ohio, a Corporation of Delaware. Filed Dec. 31, 1928. Serial No. 329,497. 6 Claims. (Cl. 62—3.)

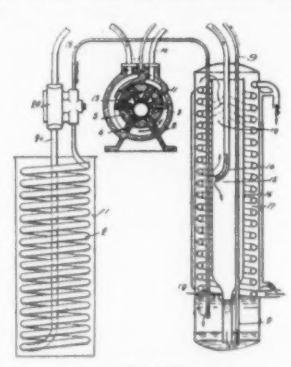
2. A refrigerating element for refrigerating apparatus including a bumper plate of heavy, rigid construction, and a refrigerant conduit secured to the protected side of the bumper plate for cooling the latter.

4. Refrigerating apparatus comprising in combination an evaporator of the dry expansion type, a pressure regulating valve for admitting liquid refrigerant to the evaporator, a chamber for collecting liquid refrigerant at the outlet of the evaporator and means for adjusting the valve in response to the presence of liquid in said chamber, including a well in said chamber and a container for expansible fluid slidably mounted in said well and connected to said valve.

1,834,987. AUTOMATIC CONTROL OF HUMIDITY OF AIR. Hoyte Hendrik Willem van Eyk, Deventer, and Johan Philip Pfeiffer, Delft, Netherlands, assignors, by mesne assignments, to The Brown Instrument Co., Philadelphia, Pa., a Corporation of Pennsylvania. Filed Oct. 1, 1928, Serial No. 309,675, and in the Netherlands June 26, 1928. 8 Claims. (Cl. 236—44.)

1. A psychrometric controlling device comprising a first indicator arm for indicating the temperature registered by the dry bulb thermometer, a second indicator arm for indicating the temperature registered by the wet bulb thermometer, a controlling arm adapted to cooperate in the known manner with said second indicator arm in controlling the relative humidity of the surrounding air by virtue of its position in relation to said second arm and a mechanical coupling between said first indicator arm and said controlling arm adapted to vary the psychrometric angle between said first indicator arm and said controlling arm so as to cause said controlling arm to cooperate with said second arm to keep the relative humidity of the surrounding air at a predetermined constant value in all positions of said first indicator arm.

1,835,081. REFRIGERATING MACHINE. Frederic Augustin Pollard, Vincennes, France. Filed July 20, 1927, Serial No. 207,093, and in France July 26, 1926. 3 Claims. (Cl. 62—115.)



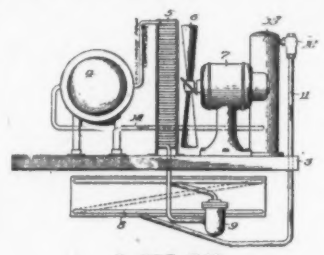
1,835,081

1. In a refrigerating machine, a refrigerating agent, a vaporizer therefor, a rotary compressor formed with an open lubricant passage including a lubricant inlet positioned adjacent the axis of rotation thereof said passage communicating directly with the interior of said compressor whereby rotation of said compressor draws lubricant through said passage by centrifugal action, a regulator for controlling the flow of the liquefied gas, and a condenser formed with a lower portion for receiving a lubricant which is continuously circulated through said condenser and through the cylinder of the compressor, means for conducting lubricant from the lower portion of said condenser to said passage, discharge means for said condenser receiving the compressed refrigerating agent and the discharged lubricant, a separating cylinder in said condenser having the lower end thereof open and normally sealed by the lubricant within said condenser and the upper end thereof open to permit the escape of said compressed refrigerating agent and a tubular member for conducting the discharge from said compressor to an intermediate portion of said separating cylinder.

1,835,463. COOLER. Philip S. Campbell, Houston, Tex., assignor of one-half to March Culmore, Harris County, Tex. Filed Jan. 14, 1929, Serial No. 332,512. Renewed Oct. 12, 1931. 4 Claims. (Cl. 62—91.5).

1. A device of the character described including a container open at the top and having a tube therein, a refrigerant compartment adjacent said container into which the tube is connected, said tube extending through the container from bottom to top and being open at one end to the atmosphere.

1,835,568. REFRIGERATING APPARATUS. Carl E. L. Lipman, Beloit, Mich., assignor to Lipman Patents Corp., Chicago, Ill., a Corporation of Delaware. Filed Oct. 7, 1927, Serial No. 224,571. Renewed Aug. 14, 1930. 4 Claims. (Cl. 62—115.)



1,835,568

1. In a refrigerating system, the combination of a rotary compressor, a high pressure side connected to the compressor for receiving compressed refrigerant therefrom, a low pressure device for receiving refrigerant from the high side, and means in circuit between said device and compressor for storing refrigerant of such quantity that when the compressor stops, the refrigerant may slip back through the rotary compressor to said means, causing a considerable drop in pressure in the high side without permitting any of the refrigerant which has slipped back to enter the low pressure device.

1,835,569. REFRIGERATING SYSTEM. Carl E. L. Lipman, Chicago, Ill., assignor to Lipman Patents Corp., Chicago, Ill., a Corporation of Delaware. Filed April 28, 1930. Serial No. 447,874. 11 Claims. (Cl. 62—115.)

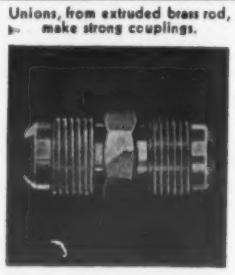
8. In a refrigerating system, a compressor, a condenser, an evaporating device for receiving refrigerant from said condenser, a closed receptacle in said suction line for storing refrigerant and lubricant therein, and means for inspirating lubricant from said receptacle into the refrigerant circuit.

1,835,588. REFRIGERATING APPARATUS. Lloyd Blackmore, Detroit, Mich., assignor to Frigidaire Corp., Dayton, Ohio, a Corporation of Delaware. Original application filed June 15, 1922, Serial No. 568,534. Divided and this application filed Jan. 24, 1928. Serial No. 249,170. 2 Claims. (Cl. 236—99.)

2. A control apparatus including a movable operating member, means for operating said member, resistance means for modifying the operation of said member, a dial, means for varying the effect of said resistance means, said last means also being operable for moving the resistance means into and out of effective operative relation with said operating member throughout the entire range of movement of the operating member, said last means including means

(*Continued on Page 15, Column 1*)

Unions, from extruded brass rod, make strong couplings.



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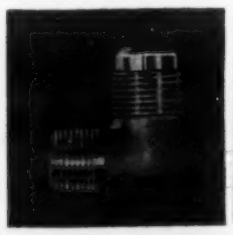

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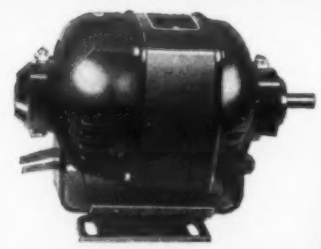

That Leland brush-lifting motors, with the special Leland cradle mounting, are unusually quiet and vibration free!

That, coupled with a continuous self-filtering lubricating system, they very rarely require service!

That Leland motors of this design are in widespread use in the field of electric refrigeration — and merit your investigation.

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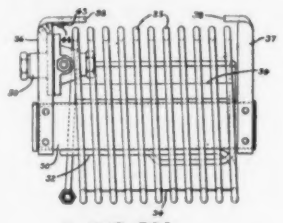
Leland Motors

Field of Mechanical Refrigeration

(Continued from Page 14, Column 5)

cooperating with the dial for indicating the position of the resistance means.

1,835,599. REFRIGERATING APPARATUS. Harry B. Hull, Dayton, Ohio, assignor to Frigidaire Corp., Dayton, Ohio, a Corporation of Delaware. Filed June 27, 1929. Serial No. 373,961. 7 Claims. (Cl. 62—126.)



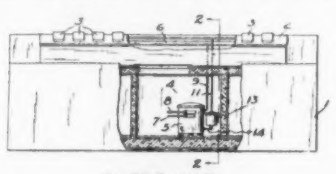
1,835,599

2. Refrigerating apparatus comprising in combination, a single continuous conduit forming a refrigerating element, said element comprising a flat spiral coil for intimate thermal contact with a horizontal ice tray, an open horizontally disposed air cooling coil formed by said continuous conduit and surrounding said spiral coil.

1,835,760. HUMIDIFYING AND AIR WASHING SYSTEM. Richard T. Cornelius, Minneapolis, Minn. Filed Sept. 25, 1930. Serial No. 484,388. 13 Claims. (Cl. 261—91.)

1. An air moistening device comprising a sump, means for supplying water to the sump including a valve, a float in the sump for operating the valve, said float having a water chamber and a metering hole through which water is supplied to the chamber from the sump, and a motor propelled water spraying spinner having a lifting cone extending into the water in said chamber.

1,835,785. REFRIGERATING SYSTEM. Herbert C. Kellogg, Detroit, Mich., assignor to The Russ Mfg. Co., Cleveland, Ohio, a Corporation of Ohio. Filed June 25, 1928. Serial No. 287,988. 8 Claims. (Cl. 62—115.)



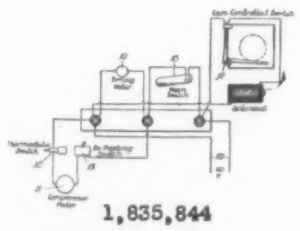
1,835,785

1. A refrigerating system comprising two evaporators, each adapted to contain a liquid refrigerant, said evaporators being in open communication one with the other above the liquid levels therein, and means controlled by fluctuations of pressure in said evaporators by pumping liquid from one evaporator to the other.

1,835,812. AIR WASHER AND HUMIDIFIER. Harry C. Ridler, Minneapolis, Minn. Filed May 19, 1930. Serial No. 453,545. 13 Claims. (Cl. 257—69.)

1. A device of the class described comprising a chamber that is open at its ends and surrounded at it sides by an air-heating means, a water supply, a nozzle connected to the water supply and arranged to project a spray longitudinally into said chamber, and means for pre-heating the supply water before delivery to said nozzle.

1,835,844. ELECTRIC REFRIGERATOR. Jack K. Butler, Chicago, Ill., assignor to Automatic Refrigerator Corp., Chicago, Ill., a Corporation of Delaware. Filed Oct. 17, 1930. Serial No. 489,283. 5 Claims. (Cl. 62—4.)

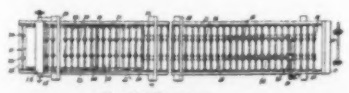


1,835,844

1. In electrical refrigeration apparatus, the combination, with a compressor motor, of a timing motor, means automatically actuated by insertion of a coin for conditioning the circuit for starting both motors at the same time, means for shutting off both motors at the same time after a pre-determined period of time has elapsed, and means for shutting off the compressor motor before the end of such period without shutting off the timing motor.

1,835,847. DOOR SHIFTED TRAY SUPPORT FOR CABINETS. Ernest A. Chandler and John H. McCann, Nashville, Tenn., assignors of one-third to Arch G. Chandler, Bessemer, Ala. Filed Sept. 17, 1929. Serial No. 329,369. 24 Claims. (Cl. 62—104.)

1,835,881. METHOD OF AND APPARATUS FOR FREEZING MATERIALS. Robert E. Kolbe, Erie, Pa. Filed Dec. 31, 1928. Serial No. 329,369. 24 Claims. (Cl 62—104.)



1,835,881

1. The method of freezing materials which consists in placing them in pans having covers, the side walls of which are spaced from the side walls of said pans, positively retaining the bottoms only of said pans submerged in a liquid medium while moved through said medium, and preventing contact of said medium with said materials.

ISSUED DECEMBER 15

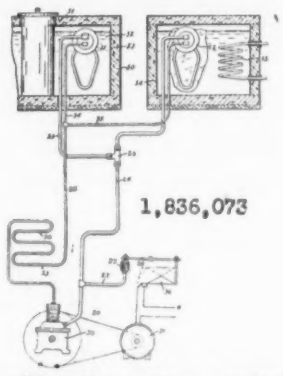
1,836,040. REFRIGERATING APPARATUS. Donald H. Reeves, Dayton, Ohio, assignor to Frigidaire Corp., Dayton, Ohio, a Corporation of Delaware. Filed March 7, 1930. Serial No. 434,095. 13 Claims. (Cl. 62—100.5.)

1. Means for storing ice blocks for domestic use, comprising a tray adapted to support ice blocks within the freezing chamber of a domestic mechanical refrigerator, and means for keeping the blocks separated from each other, said means contacting with the blocks only over a negligible surface.

1,836,072. REFRIGERATING APPARATUS. Harry B. Hull, Dayton, Ohio, assignor, by mesne assignments, to Frigidaire Corp., a Corporation of Delaware. Filed Sept, 29, 1927. Serial No. 222,900. 5 Claims. (Cl. 62—4.)

1. Refrigerating apparatus comprising in combination an evaporator, means for circulating refrigerant through the evaporator including heating dissipating means arranged to increase in temperature when refrigerant is circulated, means responsive to the pressure of the refrigerant in the evaporator for controlling the flow of refrigerant to the evaporator, and means thermally associated with the heating dissipating means for influencing the action of the controlling means.

1,836,073. REFRIGERATING APPARATUS. Harry B. Hull, Dayton, Ohio, assignor to Frigidaire Corp., Dayton, Ohio, a Corporation of Delaware. Filed Nov. 27, 1929. Serial No. 410,151. 11 Claims. (Cl. 62—115.)



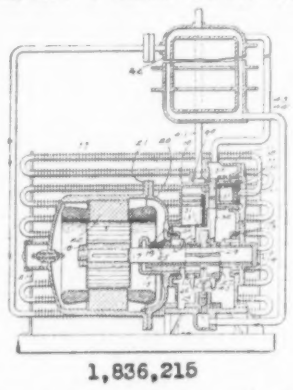
1,836,073

1. A refrigerating system comprising a refrigerant liquefying unit, a plurality of evaporating sections, a liquid refrigerant line connecting said unit and said sections, an evaporated refrigerant line connecting said unit and one of said sections, means in said evaporated refrigerant line creating in said line a zone of lower pressure of the refrigerant than in the main portion of said line, and an evaporated refrigerant branch connecting said zone and another of said sections.

1,836,090. REFRIGERATING SYSTEM. Bennet Carroll Shipman, San Francisco, Calif. Filed May 6, 1925. Serial No. 28,327. 4 Claims. (Cl. 62—126.)

2. In a refrigerating system, the combination of an evaporating section comprising two portions in series, one portion equipped with means for retaining liquid refrigerant distributively throughout and at a relatively higher level, and the other portion surrounded by a medium colder than surrounds the said first portion and at a relatively lower level, with inlet and outlet valves at the respective ends of the said section.

1,836,215. REFRIGERATING APPARATUS. George F. Woelfel, Madison, Fla., assignor to The Commercial Clearing Corp., Jacksonville, Fla., a Corporation of Florida. Filed Jan. 10, 1929, Serial No. 331,677. Renewed Feb. 20, 1931. 4 Claims. (Cl. 230—206.)



1,836,215

1. In a motor compressor unit for refrigerating systems, a compressor casing including the usual cylinder base and valve chamber, the base having horizontally aligned bearings, one of which has its outer end open, a shaft rotatable in said bearings, one end of the shaft projecting through the open outer end of said bearing, a motor casing surrounding said end of the shaft and operatively supported from and sealed to the compressor casing, a stator carried by the motor casing, a rotor for coaction with said stator carried by said end of the shaft, means for maintaining a constant oil level in the compressor casing base, means for creating a partial vacuum in said base when the compressor is in operation, and a connection between the lower portion of said motor casing and the compressor base above the level of oil therein.

1,836,221. REFRIGERATOR. Gebhard C. Bohn, St. Paul, Minn. Filed Aug. 22, 1927. Serial No. 214,464. 2 Claims. (Cl. 217—65.)

1. A refrigerating device of the character described, having a wall structure that will absorb water, said structure having a re-entrant portion at the corner of the wall, moisture-proof plates exteriorly covering the walls with their edges bent into the re-entrant portion, relatively soft wooden strips positioned in said re-entrant portions, metal strips covering said wooden strips and overlapping said plates, and fastening means passing through said metal and wooden strips and between the edges of the underlying plates into anchoring position in the frame work of the body and holding said wooden strips and metal covering strips in resilient contact with said plates, said fastening means being exteriorly adjustable and interiorly concealed within the wall structure of the refrigerator.

1,836,318. REFRIGERATING SYSTEM. Norman H. Gay, Los Angeles, Calif. Filed July 26, 1926. Serial No. 124,903. 11 Claims. (Cl. 62—115.)

1. The combination in a refrigerating system including a compressor, a condenser, a pressure regulating device, a separator and pipe lines connecting the same in a circuit, an evaporator to receive liquid refrigerant from said separator, a liquid trap at the outlet of said evaporator, an ejector connected in the circuit between the pressure regulating device and the separator, and conduits from the top and bottom of said trap to said ejector, whereby said ejector may remove the gas and liquid from said trap separately.

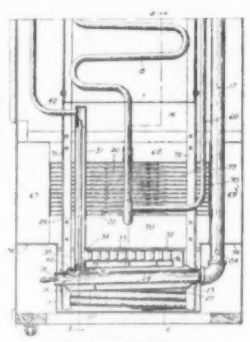
1,836,554. LATCH. Gordon E. Roedding, Grand Rapids, Mich., assignor to Grand Rapids Brass Co., Grand Rapids, Mich., a Corporation of Michigan. Filed Sept. 2, 1930. Serial No. 479,186. 9 Claims. (Cl. 292—332.)

1. A latch structure comprising: a casing having an internal transverse portion with an opening therethrough; a latch bolt extending through said opening and bearing rockably at one edge on said portion; a lever handle; a link bar connected to the latch bolt and to the lever handle to rock the bolt by the handle.

1,836,614. REFRIGERATOR. Reuben E. Ottenheimer, Baltimore, Md. Filed Jan. 31 1925, Serial No. 6,150. Renewed May 2, 1930. 20 Claims. (Cl. 62—37.2.)

1. A shelf for supporting articles to be refrigerated by currents of air, said shelf being formed with alternating ribs and channels on its upper surface and having air ports extending through said shelf and opening into said channels; and a baffle mounted upon one edge of said shelf, overhanging a portion of said ports and serving to deflect air rising through said ports across said shelf.

1,836,719. AIR COOLER REFRIGERATOR. Alvar Lenning, New York, N. Y., assignor to Electrolux Servel Corp., New York, N. Y., a Corporation of Delaware. Filed Nov. 15, 1927. Serial No. 233,366. 48 Claims. (Cl. 62—119.5.)



1,836,719

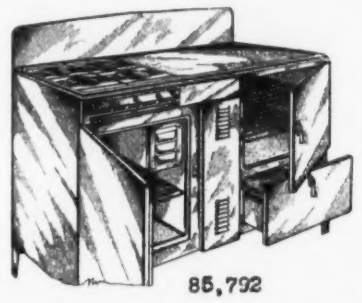
1. An air cooled refrigerator comprising a cabinet having an insulated food space, a flue adapted for flow of air extending vertically alongside said food space, said flue having a lower inlet below the food space and an upper outlet, a grid arranged at the inlet to the flue comprising a series of parallel members forming a plurality of parallel passages and an absorber set into said grid.

1,836,812. AIR COOLER. Glen O'Brien, Troy, Kans. Filed July 16, 1930. Serial No. 468,222. 3 Claims. (Cl. 257—244.)

1. In an apparatus of the character described, a housing having lower and upper chambers spaced apart to leave a transverse opening through said housing, an inlet to the lower chamber, an outlet pipe leading from the upper chamber, a funnel-shaped mouth arranged in the upper chamber communicating with and extending above the level of said outlet pipe, and tubes located in the opening and establishing communication beween the chambers.

DESIGNS

85,792. COMBINED CABINET GAS OR ELECTRIC RANGE AND REFRIGERATOR. Jacob Teller and Arthur P. Schulz, New York, N. Y., assignors to Teller Corp., Chattanooga, Tenn., a Corporation of Tennessee. Filed Sept. 10, 1931. Serial No. 41,066. Term of patent, 7 years.



85,792

The ornamental design for a combined cabinet gas or electric range and refrigerator, as shown.

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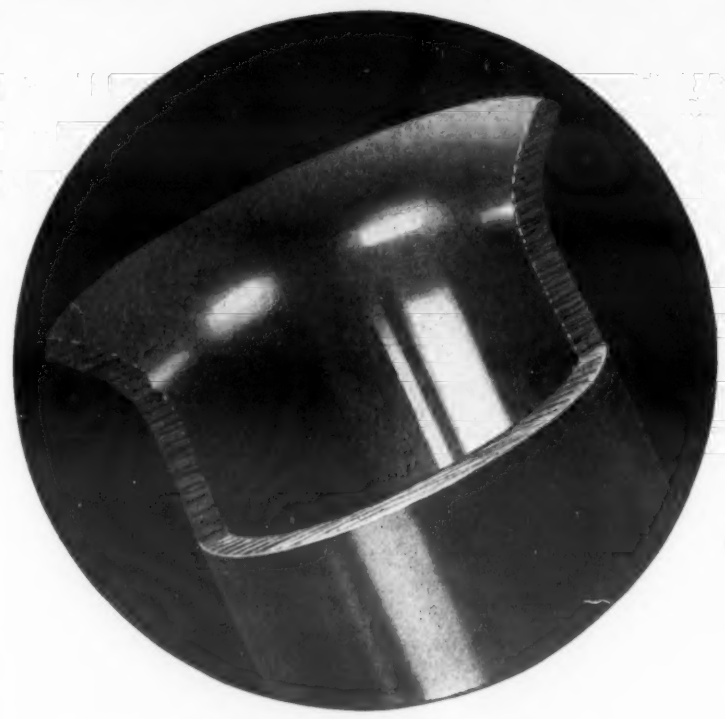

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